

EDITORIAL

THE SOFTWARE KEY TO HARD DISK SECURITY





VOLUME 5 NUMBER 15

PC Labs Tests 18 Accelerator Boards

- Data Insurance:
 25 Backup
 Power Systems
- Programming: More EGA Secrets IBM Never Told You

Plus:

- 4 9,600-bps
 - Modems
 7 3270
 Emulation
- Boards 2 AT
- Alternatives



Power for a Price







with inventive, imaginative software, and people frequently surprise us with the way they use it.

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And thank you for your interest in and support for Borland International.

Philippe Kahn,
President, Borland International

INSIDE STORIESI

Maybe no one but your mother knows you can't spell, but go on line with CompuSery. Mr. The Source and others, and the whole world knows? So use Turbo updating to save you from public electronic embarrassment. Updating check your spering on the, as you lyes, and beloate the went gets out. See mixed pages.

for more

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TOSHIBA PICKS SIDEKICK AND SUPERKEYI

CII Butted International and Techha America, Inc. New arrowanced a part marketing arrangement in which Todatiba will bundle Bertland's Stetkick, and Superkey programs on heir new Todatiba 3000 postable, and Subkick or their new 11100 PLUS porsable computers. The new Todatiba models and Bostand's software programs are IRM PC-compatible.

Reflex: The Analyst and the Wild Blue Yonder!

Andrew J. Piziali wrote us, "I have been using Reflex for several months now for both home budgeting and, would you believe, SOARING PORSCASTSI

This soaring forceast is upleaded to the local hang gidding bulletin board each Saturday and Sunday morning. Prior to using Reflex, the raw disa was plotted on a weather chart with a plastic overlay. This (new) system is much easier to use and I can mantipulate the graph scales and hypothesize scaring conditions under changing variables."

He sent us Reflex graphs showing "Thermal Index vs. Alutude" and "Temperature vs. Alutude" (both shown here), along with Reflexgenerated reports showing inversions, wind direction, knot speeds at varying altitudes, and top of convection state. All the

Bernal Index G. Alltsteb

criteria pilote need to know and need to see before they fly, because most of them know the flying maxim, "There are old pilote and bold pilote, but there are no old bold pilote."

Another novel use for Reflex, the greatest analytical tool since the couch!



CIRCLE 138 ON READER SERVICE CARD

"The reason angles can fly in because they naturally take themselves lightly."

Anarrany

Anarra

Why running your business without Borland's Reflex and the new Reflex Workshop is an act of blind faith

Running a successful business isn't something you can do with your eyes shut, but no matter what business you're in, Reflex" and the new Reflex Workshop" give you all the tools and views to see what all the numbers

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Results of Sieve Benchmark BASICA 3.1 QuickBASIC 2.0 Seconds per iteration

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*Compile entirely in memory at speeds up to 6000 lines per minute. NEW!

*Link routines once when starting a programming sex no need to link again when changing programs. NEW! *Built-in debugger with single-step, animate, and trace modes NEW!

 Create stand-alone programs. Alphanumeric Labels

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New disks recently added to c of user-supported and public software for the PC:

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 4481 Still River Shell Makes DOS easy to use 4481 Still River Shell Makes DOS easy to use 6481 Make factor Kepps track of multiple lass, sorts and prints by city, state, zip and name.

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#511 Turbo Sprites and Animation Create, maintain and enimete your own images in TURBO PASCAL.

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Company

CIRCLE 515 ON READER SERVICE CARD





COVER STORY

Accelerator Boards: Power for a Price Charles Petzold/Want the brutal truth? PCs and XTs are yesterday's technology. Advances in hardware and software development point up just how outclassed they have become. So what should you do: Retire all your PCs? Not necessarily. There are other ways to upgrade, sort of. Consider these 13 accelerator boards, straight from rigorous



Stephen Davis/This simple solution to acceleration comes on such a compact card that it doesn't even require an extra slot. What's more, it exacts a smaller penalty than its more complex siblings. Five no-slot

FEATURES

HARDWARE Backup Power: When the Juice Stops Flowing Winn I., Rosch/If there are times in the life of your office when you absolutely. positively cannot afford to have your PCs be without power, you should know about power insurance: uninterruptible and standby power supplies (UPS/SPS). PC Magazine Labs analyzes 25 units 181



COMMUNICATIONS Fast, Faster, Fastest: 9,600bps Modems Arrive

M. David Stone/High-speed modems used to run at 2,400 bits per second. The bit-persecond barrier keeps on climbing, and the prices aren't bad, but until a 9,600-bps standard emerges, telecommunicating at such high speeds will remain limited and difficult

COMPUTERS Two AT Alternatives with Personality

Jon Pepper/There are so many MS-DOS alternatives to IBM on the market that "clone" doesn't begin to describe the range of features, prices, and performance available. Two from the middle of the spectrum: the Sanyo MBC-990 and the TeleVideo TeleCAT-286 245

SOFTWARE

Protection from Prying Eyes Jared Taylor/File security is a growing concern in the multiuser office. One way to keep your files confidential is to convince DOS that what's on the disk isn't really there, which is the strategy used by the password-based security programs reviewed here ... 213

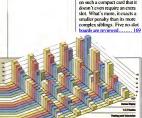
Integrated Applications: The Smart Solution Richard W. Ridington, Jr./The five standard applications in

Innovative Software's The Smart Software System (word processing, spreadsheet. database, graphics, and communications) are reasonably functional, but how well do they work together?..... 233

SPECIAL REPORT Micro-to-Mainframe Connections: Remote

Possibilities Bill Harts, Charles Teets, and M. David Stone/Personal computers with remote 3270 emulation boards can exchange data with mainframes, PC Magazine Labs reviews seven boards that operate under the





FIRST LOOKS

SuperCalc4, Perspective, Drafix I, Toshiba's T1100 Plus, QuickBASIC 2.0. The Norton Commander, and turbo boards from Microsoft, Alloy, Cheetah, and Univation ... 33

VIEWPOINTS

LETTERS TO PC MAGAZINE.

JOHN C. DVORAK IBM Steals NCC by Default

JIM SEYMOUR FCC Certification Wars, Part 1 101

STEWART ALSOP Cov I Bought Mail Order! [2] Les

PRODUCTIVITY

PC LAB NOTES More Speed from Hard Disk Drives

PROGRAMMING/ UTILITIES Exploring the EGA, Part 2 Charles Petzoldi/An in-deptlook at fonts and multiplescreen formats for the

SPREADSHEET CLINIC

Jared Taylor/Cut loading time
for 1-2-3, Release 2.0, create
of the symphony, and edit titles, 315

ADVERTISERS

Cover Photograph:
Les Mossillo

What's insidi



Speed is the only thing. Period. So the question is not "To accelerate or not to accelerate?" but simply "How?" Or so insists newly appointed PC Magazire Labs director Bill Wong, who teamed up with contribuing editor Charles Petzold to guide reviewers in the PC Labs

through an exhaustive examination of PC turbo boards. Among their many findings was that processing speed, even for a price, isn't necessarily easy to come. by—unless you're prepared to bust your budget and replace all your PCs and XTs with ATS.

Turbo cards cause radical changes in the way your machine functions. Unfortunately, some of the changes create more undesirable side effects than helpful benefits. You cannot just insert a turbo board, sit back, and enjoy the sensation. Chances are that—like the PC Labs staff—you will discover problems unlike any you've encountered before. Beware.

In the Labs, two of the turbo boards scrambled the file allocation tables (FATs) of two different XT hard disks—a dangerous situation. Some boards didn't work at all on the first go-around. In general, the Labs staff found that the bigger and more sophisticated the turbo board, the higher the incidence of problems.

PC Magazine reviewer Stephen Davis, who lives in Greenville, Texas, Rev to New York for several days to concentrate on socalled "no-slot turbo boards." Sometimes smaller (and in this ace, cheaper) turns out to be better, especially if it means fewer complications (side effects), Davis's revealing conclusions begin on page 169. Petzold, by the way, found his own definitive answer. There is a "best" way to accelerate. To find out how, read "Accelerate Boards Power for a Price," which begins on 125.

Recently, in Volume S Number 10, the Labs presented the firsts were full-scale evaluation of power surge protectors, hose beastful, but surprisingly uneven, data and hardware guardians. In the second installment of our coverage of power-regulation devices (see page 181), efectivical engineer and contributing editor Winn L. et al., and the second installment of the second power superlances vary widely in price and performance. You may not fear funderscorms, but you should fear back.costs.

If you found yourself intrigued by our exploration and reviews of re-whanced graphs sadperes in the Jugust issue (Volume 176). Number 14), be sure to check the follow-up in this issue (part 2 of Petzod/s EGA technical tips in the Programming/Utilities col-um). We've said is before, but it applies once again these tips are the most comprehensive collection of practical EGA information ovul If find anywhere. See for yourself, starting on page 287.

CONSTANT NOT COMMITTEEN REPORT

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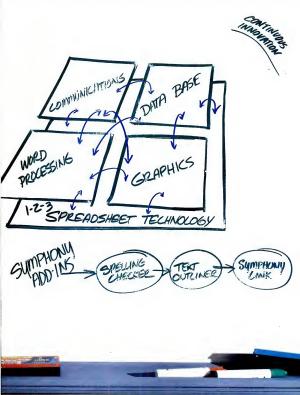
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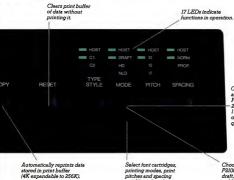
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LETTERS TO PC MAGAZINE



SURGE SUPPRESSION

I would like to compliment you on the articles "Power Corrupts (But You Can Protect Your PC)" and "Surge Suppressors: An Ounce of Prevention ..." (PC Magazine, Volume 5 Number 10). Both articles were concise and, most important, technically correct.

In the past, I have been very frustrated by the degree of misunderstanding and



misinformation that has been published about power failure in much of the media—your pieces were a refreshing change. I believe your ongoing analysis of the power area will be a very important contribution to the editorial content of PC Magazine.

In an attempt to remove some of the hype and clear up some of the confusion about power failure protection, my comparing hyp has published a small brochure on back-up power systems specifically for the computer user. For a free brochure titled "The Inside Story on Backup Power Systems for DC's, Micros and Minicomputers," call (800) 325-5848.

Robert W. McGinnis

Tempe, Arizona

Although the article "Power Corrupts (But You Can Protect Your PC)" superficially

Safe Power Systems Inc.

appeared to be comprehensive. I must criticize the lack of important information in the accompanying tables. For example, the articles states clamping voltage, champing speed, and energy rating are important features in surge suppressors, and yet these factors were not included in the summary-of-features table. Also, the article mentioned that a good device should clamp pathes down to at least 500 volts, but the speed of the summary-of-features table, also, the article mentioned that a good device should clamp splets down to at least 500 volts, but the some units, such as the Domatch Computer Power Surge Sentry DSF and the Panamax MAX 6, that clamp at much higher levels.

In addition, the accompanying article "Surge Suppressors: An Ounce of Prevention . . . " stressed the virtues of having the triple protection of a fast silicon diode, an MOV [metal oxide varistor], and a gas discharge tube, but these features were also missing from the charts.

James M. Dykes Roanoke, Texas

Your criticisms are well taken. The data that our testing produced would have filled a book, let alone a magazine. Our choices were based on all the factors taken together, not just on the information we were able to fit into the magazine. Excellent clamping in the observe of features like a warring light to show that the unit might not be functioning properly would not mertion Editor's Choice.

Our subsequent testing of PC power supplies showed that our test units could take up to 3-kilovolt surges without damage or resetting. At 6 kilovolts, neither the power supply nor the computer components were damaged, but the machine reset, causing data loss. Our conclusion is that any unit that reduces surges below a

kilovolt in all modes is adequate protection for a PC.—Ed.

ANOTHER VIEW OF IBM

I wanted to respond to your cover story (PC Magazine, Volume 5 Number 8) that featured the IBM PC AT and its problems by summarizing the excellent treatment IBM gave me and my AT.

After writing to Robb Wilson at IBM





about intermittent hard disk problems on an out-of-warranty AT purchased in December 1984. I was contacted by an IBM customer-relations representative who asked me to return the machine to my dealer. At their expense, IBM replaced the system board and fixed disk.

IBM's attention to this problem has been excellent and in contrast to the overall tone of PC Magazine's series of articles in that issue. Choosing IBM equipment not only is a safe bet, but the equipment is accompanied by a first-class company.

Gary S. Swindell

Gary S. Swinde Dallas, Texas

POINT-COUNTERPOINT

I read with interest your article "Guru: Brave New Expert System?" in PC Magazine, Volume 5 Number 10. I agree with most of the reviewer's comments. However, I must say that I was disappointed with



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LETTERS

the view expressed by Charles Petzold in the Counterpoint sidebar.

Petzold clearly showed a lack of objectivity. He seemed to attack the area drafticial intelligence and expert systems in general, rather than Gwar itself. I man Gwar itself i may be been writing detailed and sophisticated expert systems involving the application and interpretation of highly technical legal matters. Without the use of Gwar. Just and the control of the control of

Pierre Lessard Montreal, Quebec Canada

Charles Petzold responds:

As I Indicated in my Counterpoint, I do believe that expert systems like Gutu have a value and usefulness in certain specialized fields, and I certainly would not discourage their use in these fields. The interpretation of "highly technical legid matters" you mention is obviously one of the applications for which an inference engine generating the implications of if-then-else statements can produce accurate results.

However, Guru pretends to be more than that. Guru pretends to be applicable for general-purpose business decision making and problem solving. No way.

I hope to eventually see artificial-intelligence systems attain that degree of sophistication, but it's obviously going to need a natural-language interface and learning abilities that far surpass the crude, simple logic of Guru. Only then will Guru's claims match the program's function.

A FORM OF CENSORSHIP? I read with some interest Jim Seymour's

column "Advise and Consent" (PC Magazine, Volume 5 Number 11). I concur completely.

But spare us the recommendation of

But spare us the recommendation of programs advocating various forms of censorship. Mr. Seymour would have a program that caught "sexist" language. Let's face it: the demand for so-called inclusive, or nonsexist, language is no different from, say, a fundamentalist's demanding removal of books with four-letter words from schools and libraries. If you want to

write or speak in that manner, that's fine; but don't try to impose your brand of cen-

sorship on me.

As a speaker of standard English and a linguist, I find these "he/she" phrases irritating and distracting. PC Magazine might well take a cue from The New York Times and eschew all such neologisms as spokesperson. They are not neutral, just depersonalizing and lousy English.

Enter Winston E. Inesee

Superior, Wisconsin

AN ENCOURAGING WORD

I want to encourage you to maintain your software-review policy. I am concerned that you might be tempted to weaken under the constant barrage of letters you must receive, such as the one from Computer Associates regarding SuperProject that appeared in PC Magazine, Volume 5 Number 10. Remember, even though vendors pay your salaries via advertising revenues, end users like myself pay for everything in the long run. As the final pocket, we need to have objective reviews of software as it actually exists, not as some hype-type envisions it might work "real soon now." We need you, so hang in there.

Thomas V. Baker Portland, Oregon

CASTING SIDEKICK ASIDE

I believe that readers of your article "Desktop Organizers: Top-noth Efficiency Tools" (PC Magazine, Volume 5 Number 10) would be interested in knowing more about SideKick, a product not included in your review.

Bediant helped establish the desktop organizer market by teaching people what a desktop organizer was and how such a desktop organizer was and how such a MAM-resident local could increase productivity and computing enjoyment. Since Bedraid introduced SideRick in June of 1984, the product has become a standard or the desktop-software market, and many products have imitated the SideRick model in one way or another. Since more middle organized to the SideRick bears soft, as e must be doing something right.

Robin Shepherd Borland International Inc. Scotts Valley, California PC Magazine reserves the right to establish selection criteria for choosing the products it includes in reviews. The purpose of the article on deskup organizers was to discuss we products, and the products reviewed fulfilled this intent. For more of the products of the prodtor of the products of the prodtor of the products of the protor of the products of the products

ONJUNE INVESTING

PC" (Volume 4 Number 2).-Ed.

In your article "A Guide to On-line Investing" (PC Magazine, Volume 5 Number 10), you omitted several of CompuServe's features from your table. These features include quotes on market indexes with a 15- to 20-minute delay; real-time quotes on options and market indexes; historical pricing and dividend information on stocks; price histories on market indexes, options, commodities bonds, and mutual funds; the range of SEC data for 9,500 publicly traded companies; price/volume charts on securities; reports from major brokerage houses: stockholder and ownership information; and industry news from the Associated Press and several financial newsletters.

We feel that CompuServe offers the premier mix of financial information for investors, a fact that should become apparent in any careful examination of on-line services.

Richard A. Baker CompuServe Inc. Columbus, Ohio

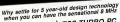
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PC ADVISOR



Help for readers in finding the best way to control two printers and in selecting the least expensive monitor for use at home.

DOUBLE PRINTER DUTY

I'm having problems getting my PC to switch between an Okidata 81A on the monoparallel port and a Panasonic KX-PIOPS can and ST Six-Pak parallel port. I can't seem to get the right codes and still allow AST's SuperSpool to work properly. I think a dream package would be a memory-resident printer controller that could not only change fonts and styles but also run its own spooler and switch between numerous LPT ports. Is there such an animal?

James Crowley West Seneca, New York

Attempts at creating such a superutility have been made, but we wouldn't recommend any of the ones we've seen that would work on both your printers (most printer utilities are compatible mainly with Esson and 1BM printers).

Let's tackle your problems one at a time. SuperSpool needs a patch to make it switch between parallel ports. We printed it in the February 5, 1985, issue (User-to-User, PC Magazine, Volume 4 Nimber 3; copy of that issue). However, to make the switch you need to quit your application and run a batch file (which may interfere with some memory-resident programs).

More convenient would be an A-B switch (less than \$100 from mail-order houses) that you run out of LPTI and connect to both printers; choosing a printer is then as easy as flipping a switch. A print spooler that can accommodate two printers will give out he same convenience and provide the added benefit of freeing up the RAM your software buffer is using. The Printer Optimizer (Applied Creative Technologies, Dallus, Tex., 214) 358-4800; 3509) and the Microbuffer In-line Buffer (Practical Peripherals, Westlake Village, Calif.; (818) 991-8200; 2299 for 32K bytes) are among the few spoolers that can handle two printers.

As to controlling text styles, a great printer setup program was published in Programming/Utilities in our June 24, 1986, issue (Volume 5 Number 12), While it was designed to send setup strings for only one printer, the column explains how to customize it using DEBUG's since the program offers 20 selections, you could set up both printers with it.

USINGATVWITHAPC

I use an IBM PC-XT at the office and would like to obtain the best compatible system for home use at the lowest cost. My uses would be budgets, children's educational programs, and games. Is it possible

 One way to maximize your tube use is with a combination color TV/monitor from either Sears or Sony. to use a color TV set as a monitor for such a system? The cost savings in that approach may make it my best choice.

David M. Fochs
Appleton, Wisconsin

A color TV will be fine for games and graphics if you patch an RF modulator or Ralio Shack's TV/Computer switch Cat. No. 15-1268; 54-95) into the line between the video card and the TV. Jast be sure the colorigraphics adapter card you buy has no RCA video jock (most do). In text mode, however, resolution will be anylid; only programs, such as DOS and BASC, that can switch into a 40-column mode can be made lexible.

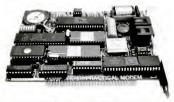
One way to maximize your tube use is with a combination color TV/monitor from either Sears Roebuck Co. (Sears catalog no. 40841; \$340) or Sony Corp. (Model KV-20XBR with a 20-inch screen, \$939 plus \$80 for the PC701 nine-pin adapter; or the KV-1311CR with a 13-inch screen, \$629.95, no adapter required).

Then again, maybe the last thing you need is another color IV in the house. Why need is another color IV in the house. Why not buy an inexpensive composite monitor? Some mail-order services are selling them for as little as \$80 to \$100. You'll be able to do your work on the monochrome screen without eyestrain, and when it's time for fun, you can hook up the IV.

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If you use Lattice, C66^{1/4}, or Wizard, and taxe 330k, you can compile your C program without ever leaving Bine! If finds the lines with errors, and marches you through the text for repairs Parts of Brief were written with its own Lisp-like macro language which has

structure, 32-character variable names.

conditional execution, loops, and you can actually send if Notting like the

Simply the best test editor y

can buy: Dvorak Infoworld (Needs 192k.) PC Brand 110590 1195 HALO GRAPHICS SYSTEM Multi-Board Graphics Library

demo source files on disk

The premier graphics library that got the ball rolling for PC based graphics and has grown so omnipotent that it supports over 25 graphics boards — includes TMAY. EGA and Nr. 9 Resolution's humas series and has a multipude of mouse and printer drivers. All that in each box Separate C versions for Lattice, M'soft. Astes, C186 What does Multi-Halo do? A down to the lest breef drawers so distributed blockers or wast does with large do. V down to me run on anything. Wonderful value for single hoense. Costly royalities though for redistribution Specify S03tS & Langua Last *300. We *219. With Dr Hato III a standing 'paint' Lest *440, Us *299. ectly SOOIS & Language

WINDOWS for C/WINDOWS for DATA Microsoft Windows™ and TopView™ Compatible

W indows for C™s a library of over 80 functions to add the peazz and prac application Unimited windows each defined in a C structure for easy referen throughout your program, can be made either to pop up or permanently overwrite the screen. Rownes will scroll and highlight lists with arrow keys will read and acroil ASCII files wertcally and horgontally in windows, and even write to Logical treatment of video attributes permits unchanged programs to run on color or monochrome. Colors of wandows

are set individually All functions are in separate moduli only those used are linked. Only buffers holding on screen or temporarily obscured windows occupy RAM, others released dynamically Best overall rating and fastest display in Bill Hunt's 7/85 Tech

Journal review of five windowing products
Windows for Data comprises all of
Windows for C but takes in data through the windows as well. At the high level a single function lets you specify prompt string, field length, data type, screen on, picture, target variable, then see lesser functions scurrying to get and process a user's input. There are unlit not system date and time mess with strings, create your own masks for fields Field options can require entry, prevent errry, permit insert or overtype, been on invalid or overflow keystrokes, and strachment of field-specific help messages

C-TREE

B-Tree File Manager, Source Code, No Royalties! C -tree is sturdy code that has weathered many seasons of pro

longed and widespread use ft comes in C ir binary application Ctree's design splits nodes to allow any number of users to access an index file smultaneously even when updates are in processes. So multi-user configurations and adactation to networks are possible

Record-locking routines are provided for dBC Lattice Library Maintains dBASE Compatible Files With the Power and Speed of C Use dBC for custom work for clients, or

d BC^{IM} halo C to dBASE it creates and maintains files and their indexes which exactly replicate dBASE file design. So dBASE can rectal and update them. And the precise dBC can use any files created by dBASE New C and dBASE can operate in the same data bases interchange ably. on its own it's a complete ISAM file manager for C whether or not dBASE will memory models, and can have someen index and data files open. Big discount to buyers of both dBASE II and III wersons on the same data cased interchange acry.
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to the next or prior, qualeto Options diverse enough that a set of "fields" can be made to behave like a Lotus' meru Snecufy Compiler Lest PCB T0000 Windows for C T0(S) Windows for Data 1296

C-WORTHY LIBRARY Fits Out Applications with Shipshape Interface

N or the usual flottlia of functions for small crafting, but a formsdable battle wagen for major C engagements. CWorthy¹⁵⁴ wraps an entire user unterchecking cluster from your core program Your application is nested in this power ful environment. CWorthy's architecture face around your application lits full power can be summoned by only a few high level uses Cs pointers to functions to drive your application C Worthy includes utilities to mainta calls. Proof? A single function call sets up a text files of help and error messages. Their complete text editor in a screen window . High level calls pop menus and scrollable segregation means applications can read lists to the screen, restoring the background when dismissed and branching ly be translated into foreign languages without program rewriting. Plus display he chosen activity in your applic Decomposed low level functions used by the bigh level calls are supplied. All . Windowing faculties open portholes of machine dependency is housed in inter-

changable overlaw loaded at run time management. Keyboard entry routines Thus no recompulation needed to run on a mix of PC and MS-DOS machines look for the help key and interrupt with paged text windows explaining what to do.

• Full error message interface sends error codes to C-Worthy which discusses pro-C.Worthy hands you a consistent and design approach. Novell found is "played a key role and accelerated development" making NetWare"* easier to use "You o if to vourselves to take a look Specify Compiler

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Ctree permits any number of keys for a

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memory supports color, vast fun get characters, wrap lines, scroll, blank lines highlight etc Like Unix refreshes screen only on your command. Ask for L0690 Let *125 Here *99 With Source L0690 *250/*199

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one is for programmers.

Words don't express program ideas screen - a snapshot of your planned pr duct as it runs. Anything goes words. borders box rules inverse and underlining on this take to an empty scree Change it a little, to show the next instant of run time. Do it again. Paesto, a whole slide. All 250 characters and attributes are

available from scrollage lass wash pop-the screen. All commands are layered in Lotar-style pop-up nierias. Frequent

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OTHER TOOLS

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The HAMMER by OES Systems

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This Cinterpreter behaves like PC BASIC
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mory Use Long the overload of overlay linkers, standard Plink96 shoehoms large programs uto small machines by sharing memory swapping program segments in from disk: A \$12k program could run in a 128k machine for example. The Plus version goes beyond if it finds itself in a larger machine, it moves whatever program clays that fit unto leftower m Dierland now sweep at memory speed not disk speed it also can automatical restore a displaced overlay to which a

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LATTICE C COMPILER

passing between structures by assign The greatly expanded libraries (325 and. Lattice has empired pre-eminerors in long that developers have created far more snap-on tools for Lattice C than any other compiler William Hurris PC Tech Journal renew of 12 compilers awarded Lattice the only "very good" rating for add-on library availability. functions) enable the file sharing and record locking provisions of DOS 31, pro vide a full complement of transcendent and a host of utilities to mimic the UNIX and XENIX™ environments. Lamoe 30 defaults to the ANSI prop Ask for

Major Upgrades to the Best Selling C Compiler

standard when you need strict adherence. command line opports restore lettericy And it adopts ANSI checking of externa function arguments by data type to kill bug BETTER BASIC awarms when modules you up at link time Convert Microsoft BASIC.

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intermixing Or boost productivity with twin CRTs Load object code of functions

mercial libraries. Interactive Chas immedisse mode, syntax checking both as you

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100% compiler compatible — right down to header files and library calls. Port pro-grams between Interactive-C and your

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you have already compiled Or of com

type and run, and cursor positioning

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GSS Kernel^{1M} conforms to level 2b of

ANSI's Graphical Kernel System (CKS) and

contains all its needed drivers and language hindings. Kernel has magno level tools to draw and color an obsect, store the sequential instructions, and recrease the object on its own, as well as segment it. transform it, etc. So powerful, a single com mand may represent several score lower Plotting has the equivalent GKS tools for graph and chart generation and their cap and it bakes the numbers into a digestible display for screen or plotters Kernel and Plotting have tools to conve

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Each Hard DiskCard comes complete with everything you need, installs in minutes, boots off the hard disk, has a programmable inter-leave factor of up to 1-to-1, "" and has plated media. You can add it to an existing hard disk and, for an extra \$95, have both disks act as one.

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If you re someone who hates reading installation manuals or who gets intimidated installing internal disk drives, one of the Express Hard DiskCards** is for you. Simply insert it inside your IBM*PC, XT. AT or compatible, like any other add-on card.

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Express Hard DiskCards give you from 20 to 60 megabytes of rigid disk storage, and something more. The controller comes with a programmable interleave factor of up to 1-to-1, which means that you retrieve data up to 6 times faster than the PC XT which has a 6-to-1 interleave controller.

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The Express Hard DiskCards, with an average access speed of 60 msec, gives you—in addition to that extra speed—head retraction. Before you start thinking you've just got to have head retraction, you should

know that the 80 moce Express Hard DiskCards are rated at 50 gb power off and 10 gb power on. Furthermore, our 80 mace Hard DiskCards, like all Express Hard DiskCards, like all Express Hard DiskCards, like all Express Hard DiskCards, have plated media; iron oxide (it looks and acts like rant), which means if the head bits the iron oxide, it will gouge out media and your data along with it. Plated media, on the other hand, looks like a car's chrome bumper. If the head hits, it will cause little offers drives with high tel orderness.

or no damage. That's why Express offers drives with high g tolerances. All of the benefits of our 80 msec drives aside, you may want to get our 60 msec drive just for the extra seed. But in addition to increased access speed, you'll be getting automatic head retraction.

50 percent faster

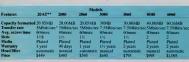
Our 30 and 60 megabyte Hard DiskCards give you more storage space, but in addition, they also give you a transfer rate of 7.5 megabits per second—a full 50 percent faster than an IBM XT or AT hard disk. Paster speed is important, and becomes more so if you want to combine disks.

One File, Two Disks

With Express Systems new Coalesce's Software, you can add our 20 or 30 megabyte Hard Disk-Card" to your existing hard disk. They will both work together as though they were one disk—up to

144 megabytes worth.
Coalesce not only merges the
two hard disks together, it bypasses
the DOS barrier of 32 megabytes.
That means that if you already own
a 114 megabyte hard disk, you can
add our 30 megabyte Hard DiskCard and have a total of 144 megabytes as a single file!

However, if you don't have a













ocompanies like AT&T, HBM, Bell Labs, IPolaroid, Kodak, 3M, LJC Penney, Sperry, IHughes Aircraft, Stanford University,

IDiscover why Allied Corp. the Associated Press and others have bought Express Hard IDiskCards.

I hard disk now and want 40 or 60 megahytes of hard disk storage, then our Express Double Disk-Card" comes with two hard disks. You can use one disk to back up the other with our automatic hackup software Auto DiskSave" or for an extra \$95, you can huy Coalesce s and have both disks work as one

Free backup program

AAll Express Hard DiskCards are savailable with a free backup prog gram, DS Backup." This easy and convenient program-a \$69.95 v value-makes backing up simple s and fast. And to receive it, all you If have to do is ask for it when you order.

AT Backup DiskCard*

How would you like to know that your IBM AT's hard disk is always hacked up without having to think about it. With Express Systems' AT Backup DiskCard" you can f have 20 megabytes of hard disk backup on a card without taking up valuable front panel space. The AT Backup DiskCard comes with Auto DiskSave software, so you



	Formatted Storage Capacity in Mbytes	Height	Plated Media	Average Access	Comments	PC or PC/XT	AT
	10	1/2	no	85 msec	Low power	\$ 295	N/A
	21	1/2	ves	85 msec	Low power	Call	Call
3	32	Full	no	30 msec	CDC WREN II drive	\$1,295	\$1,195
1	72	Full	no	25 msec	Ideal AT drive for LAN	\$1,795	\$1,695
ı	144	Full	no	30 msec	2 72MB drives as one volume	+	\$3,395
ı	Remova	ble Ha	rd Disk				
ı	10	100	ves	90 msec	5 Mhits/s	\$1,095	\$1,095

90 msec Tape Systems and Subsystems Formatted Storage Capacity

60 Mbytes 60 Mhytes Subsystem 1 Mbytes (unformatted) Start/stop Subsystem 24 26 Mbytes Floppy Tape® Subsystem

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Any of our disk or tape units are available in an external subsystem for an additional \$250.00. You can mix & match any of our 1/2 high hard disks or tape drives together or add any single full height hard disk. Power Supply 150 Watt Power supply \$75.00#

#with any purchase of PC or PC XT replacement

Upgradable

can backup by date, time, archive

bit (since you last used a file), by

subdirectory, file name or groups

of files, or any name combination

using DOS wild cards Further-

more, you can schedule your

hackup for anytime you return to

If you're worried about 20 me-

gahytes not being enough space,

we include Express Systems file

compression software. File Com-

pactor," which compress binary

files 30-35 percent, text files 40-50

percent, and data base files up to 90

percent of their original space.

And not only will you not have to

think about backing up your files,

the AT Backup DiskCard will do it

file-by-file at the rate of 3 megabytes per minute

The Express Hard DiskCard is

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ule with its own 5MHz clock, speeding up PC/AT math by 25%. (Pictured above.)

Now, Hauppauge Unweils the 287 FAST/10... Our newest math coprocessor for the FC/AT, the 287 FAST/10 moves out at 10MH2—more than doubling the speed of each floating point math operation. The FAST/10 accelerates AutoCad, 1-2-3, Symphomy, Turbo Pacal, Framework and more. The FAST/10 also runs in FC/AT compatibles including the Compan Deskpro 286, Sperry PC/IT and more 286 accelerator boards.

...And the 87 Software Pak Version 6.0 Designed to stell the heart of programmers, the 87 Software Pak supports IBM's BASIC Compiler I.0 and 2.0, and Microsoft's OpiciBASIC Compiler I.0 and 2.0, and Microsoft's OpiciBASIC Compiler Basic Pak also performs FFT-and Martix operations. For example, a PC (or PCXT) with an 87 Chip and 87 Software Pak can perform 87 Sport compiler FFT in just I.1 seconds. What's more, a PCAT with a PAST/10 inverts a 25 by 25 element matrix in under 1 second.

CIRCLE 276 ON READER SERVICE CARD

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BM PC/AT and 5.33 MHz in the naw
model PC/AT.\$219

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FIRST LOOKS

SuperCalc4 Stalks 1-2-3

PANDS ON

Equivalent speed, better graphics, and no copy protection.

BY M. DAVID STONE

As a spreadsheet program, SuperCalc is regarded as being in the same class with Lotus's 1-2-3. In the marketplace, however, it's more of an also-ran than a close competitor. Super-Calc4 is Computer Associates'

SuperCalc4 does have its advantages as a competitor to 1-2-3. The most important one is that it isn't copy protected, so

installation is no problem. SuperCalc4's graphics capabilities are vastly more advanced than 1-2-3's, too. Performance tests show the two programs to be roughly equivalent in terms of speed. I timed a test file using just arithmetic functions and found that 1-2-3 Releases 1 A and 2 both recalculated in about two-thirds the time of SunerCalc4 (see the benchmark test results). On a test that sorted a list of

were reversed: SuperCalc4 was the winner, resorting the list in two-thirds the time of 1-2-3. And when I added a circular reference to the arithmetic test, SuperCalc4 again beat 1-2-3 because 1-2-3 recalculates the

while SuperCalc4 calculates only the circular reference. Nonetheless, the arithmetic test is probably the more representative, although 1-2-3 is far from being an uncontested winner. If you're familiar with SuperCalc3's single-letter command menus, the most obvious difference is that SuperCalc4

entire spreadsheet each time.

for the slash commands. Not all of the changes are cosmetic either: the command structure has changed-some commands are missing, others are added. To its credit, instead of orphaning its earlier products, Computer Associates has retained the "missing" commands in SuperCalc4 as a hidden subset. This means that macros written for SuperCalc3 will still work.

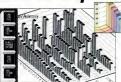
New commands include a named range command. This feature, which brings Super-Calc4 up to date with 1-2-3, lets you name a range of cells and (continued on page 35)

Perspective: Eye-popping 3-D Presentation Graphics

HANDS ON

BY BILL MACHRONE Sometimes you need to put a lot of graphic information in one place. At other times, the shape or texture of the data is more important than the actual points. And often your data just needs a fresh, dramatic look. In each case, a 3-D graph may be the an-

Perspective, from 3D Software, makes it easy with spreadsheet-style data entry, a large library of display styles, and one-finger operation. You enter data directly into its spreadsheet (limited to 64 rows by 64 columns) or import it in DIF format. Perspective doesn't read .WKS or .WK1 files.



(inset) accompanying "Accelerator Boards: Power for a Price," Page 165, For now, Perspective supports the Hercules card; an EGA version is due this fall.

After you've entered your | data, Perspective gives you a menu of 31 three-dimensional and 15 two-dimensional graph styles. If these standard styles

aren't exactly what you want. Perspective lets you change every element of the graph, including the grids, the style of (continued on page 35) HANDS-ON INDEX SUPERCALC4 Comparable speed, better graphics than 1-2-3 33

PERSPECTIVE Powerful 3-D graphics 33 **DRAFIX 1**

Best \$295 CAD package 34 ACCELERATOR BOARDS Microsoft MACH 10, Alloy Bi-TURBO, Cheetah Card/70 and Combo Card/70. Univation Dream

Board TOSHIBA T1100 PLUS Everything an LCD laptop portable should be 38

OUICKBASIC 2.0 Microsoft's competition for Turbo Pascal 46 **MORTON COMMANDER** Famous-name DOS shell 55

DICONIX INKJET 150, LAPTOPP ONTHEGO Battery-powered printers

for laptop/portable users 55

\$295 Drafix 1: Best Bet for Affordable CAD

PP: HANDS ON

More power and features than AutoCAD's \$300 package.

BY GLENN HART

PC-based computer-aided design continues to be dominated by Autodesk's AutoCAD, which recently cut its base price from \$1,000 to \$300. One program that can hold its own against the AutoCAD juggernaut is Foresight Resources' Drafix 1, which was introduced earlier this year at \$1,500 and now is but \$295. Drafix I is more complete than the stripped AutoCAD and is superior to oth-

er low-en/1 competitors as well. Drafix I features a remarkable user interface that is easy to



With Dealis, 1'x text-based interface, you can select any visible command, object snow mode, or operating condition, At \$295, Drafix 1 is an excellent value.

learn and use, yet fast and flexible-perhaps the best on any CAD. It's sort of a mutant of the Macintosh approach, with pulldown menus and the like, but it's entirely text-based.

Drofix I uses a hierarchical menu structure for commands. and the lower levels are always

higher levels. Any visible command can be selected directly. minimizing the annoying navigation through menu structures typical of competitors. Operating conditions and object snap modes are displayed along the

visible in a thin strip below the

left edge and can be selected with the pointer or from the keyboard whenever convenient. even during the execution of other commands. At the lower left, a three-box display shows the effect of pressing each of the three buttons on the mouse (two-button mice and digitizers work, too). The contents of these boxes change as specific commands are selected.

Drafix I's input provisions are unusually flexible. Absolute, relative, and polar (angle and distance) coordinates can be entered. A fine orthogonal and angle-locking system helps you draw perpendicular and angled lines easily.

Excellent Control Drafix I offers excellent con-

trol over its operating parameters. Grid display and snap grid can be independent, and the cursor can either roam or lock to snap points. You can change the snap dynamically while drawing-a great convenience. You can specify the size of the sheet you'll be plotting on, set exact scaling, determine screen colors for almost every display element, control many aspects of the dimensioning system, and much more.

Image manipulation is good, with zoom, pan, redraw, and other common features. You can save up to eight numbered views of an image and can recall them instantly.

In addition to conventional lines, arcs, circles, and other such entities, Drofix I draws parallel lines with variable width and offset. You can also create lines perpendicular or parallel to existing lines, tangent to one or two circles, and more. Boxes and polygons can be drawn directly, filled with color, and exploded into segments. Erasure is flexible, with regional and entity-limited erasures, and the ability to restore

Fillets and chamfers, very good trimming and stretching systems, hatching, grouping entities for erasure, moving and copying, slides, and much more are included in Draftx 1. Symbol libraries are easy to create

the last three deletions

(continued on page 58)



Draftx 1, Version 1 Foresight Resources Corp. 932 Massachusens Lawrence, KS 66044-2868

(913) 841-1121 List Price: \$295; AutoCAD import/export utility, \$95; largeplotter driver (needed only for larger HP, HI, and Calcomp

1043 plotters), \$150 Requires: 512K RAM (640K preferred), mouse or digitizer, DOS 2.1 or later. Works with CGA, EGA, Hercules, Sigma 400, Conographics 40, Tecmar Graphics Master, and AT&T PC graphics cards. 8087/80287

In Short: A first-rate, full-featured professional CAD program at a bargain price. More features and more complete than the basic AutoCAD. Not copy protected.

CIRCLE 421 ON READER SERVICE CARD

Drafix vs. AutoCAD vs. In* A* Vision

Should you buy Drafix 1? | AutoCAD? An easily learned drawing/CAD program such as In*A*Vision?

Drafix I's avowed target is the "design and drafting professional." Don't be fooled by the \$295 price-it really is suitable for that market. Drafix I may be too complicated for rank beginners (as would most highend CADs), but the price makes it attractive for entrylevel users who can grow into its capabilities. Drafix 1 is far more complete than the basic AutoCAD package (\$300).

I'm a great believer in going with de facto standards. and there's a lot to be said for AutoCAD's dominance and the wealth of third-party support programs (250-plus at last count). I would probably recommend the basic AutoCAD to users looking for low-cost stations integrated with larger and morecomplete AutoCAD stations. But Drafix I is more than most people will ever need and costs an order of magnitude less than a full copy of AutoCAD (\$2,750).

Micrografx's In*A*VIsion (\$495) is a very different type of program; part drawing, part CAD. It's much easier to learn and. perhaps, to use, but it's also limited. There are people who find In+A+Vision sufficient, but if it's real CAD you want. Drafix I is a lot more program for little more

than half the price. For more on PC-based computer-aided design programs, see "CAD: The Big Picture for Micros," PC Mogazine, Volume 5 Num--Glenn Harr

SuperCalc4

then refer to the range by name without having to worry about columns and rows.

Another notable feature is a slick new importexport scheme that makes transferring files to and from 1/-23 almost ascays as loading and saving files in SuperCale 4 format. To export a file to 1/-23, choose the export command, choose 1/-23, and then indicate the filename. Importing is equally simple; you don't even have to specify Release IA or 2, SuperCale 4 reads the file extension and adjusts its translation secordingly.

transtation accordingly.

In PC Magazine Labs tests, I translated files in both directions, including a SuperCulc4 file with graphs already defined. 1:2-3 retrieved the file and displayed the graphs without problems. As expected, the graphs looked better in SuperCulc4 because of that program's

better graphics capabilities.

In draways perfect. SuperCale4
can use ten variables in a graph,
while 1-23 can handle only six.
Also, SuperCale4 has a maximum size of 255 columns by
9,999 rows, while 1-2-3, Release 2, has 2.56 columns by
8,192 rows (both programs use expanded memory). In each
case, the conversion throws out



SuperCalc4 Computer Associates 2195 Fortune Dr. San Jose, CA 95131 (408) 942-1727 List Price: \$495; upgrade from Version 3, Release 2.1, \$20; Version 3, Release 2.0, \$100. Requires: 256K RAM. two disk drives, DOS 2.0 or later. In Short: This major upgrade to SuperCalc3 adds named ranges, 1-2-3-like full-word menus, a vastly improved macro capability, and the ability to transfer files to and from 1-2-3

with ease. Not copy protected.

CIRCLE 444 ON READER SERVICE CARD

SuperCalc4: Always a Bridesmaid

In a world without 1-2-3, SuperCale would be a program we'd all rave about. But this isn't a world without 1-2-3,

is it?

The people at SORCIM, and now their successors at Computer Associates, have led the way time and again with infinitely better graphics. support of the 8808/780287 math coprocessor, sparing use of RAM, easy circular-reference resolution, sideways printer support, and site licensing—all the features that Lotus should have provided accurate.

ple of releases ago.

But still the sales and installed-base gaps widen.

Using 1-2-3 is, forgive me, like unfolding a delicate the extra data. A well-organized

these differences.

Macros are also lost in translation. This is a shame considering how good the new macro feature is. SuperCales macros were stored in "execute files," which were clumy enough to drive me to ProKey. Super-Cales still uses the execute files, but it can also store macros in the current spreadsheet as

appendix carefully documents

text. What's more, a "learn" feature can create a macro by following your keystrokes. You can even use the macro feature to create custom menus.

tt 1-2-3, Suca program but, But this hout 1-2-3, spite all the things we'd like to see fixed or changed in \$SORCIM.

is a lovely process.

Each new discovery
makes you realize that Lotus
got there first in designing a
better spreadsheet—and, often, did it just the way you
would have.

If you were very, very good. That internal elegance

surpasses even raw speed in my mind when 1 grope for why 1-2-3 always has outsold and—forgive me Computer Associates—always will outsell SuperCalc.

between 1-2-3 and SuperCalc4 as the command paths in the two programs are different. In general, SuperCalc4 commands take fewer keystrokes—largely because there are more com-

-Jim Seymour

mands on the first menu level. SuperCaleA is a serious at tempt to do 1-2-3 one better. Computer Associates is surely aware of the put implicit in its product's name ("Move up from 1-2-3 to 4"), but it has also taken the time to make the pun meaningful. SuperCaleA retains everything that was good about SuperCaleA. borrows much of what is good about 1-2-3, and what is good about 1-2-3. And superCaleA.

Perspective

the risers, the row or column spacing, the base, the legends, and the shading. You can create a "look" file that captures the specs for a custom graph and apply it as a template.

ply it as a template. One of the biggest problems with 3-D presentations is data points that become obscured by other data points. Perspective goes to great lengths to solve this problem. You can rotate your graph in any of three axes. You can move the graph around on the screen. You can stretch or compress any of the three axes, and you can force the perspective from narrow to wideangle. A menu screen gives you 16 standard perspectives, any of which can be used as a starting

point for custom looks. Perspective is mostly virtue, with very little vice. Its biggest limitation is that it currently runs only on the Hercules graphies eard and monochrome monitor. An EGA color version of Perspective is scheduled for release later this year. In the initial version, however, the number of printer drivers is also somewhat limited. The popular ones are covered, such as the all-important IBM Graphics, as well as Epson, Toshiba, Okidata, and Gemini. But it needs a 300-dot-per-inch HP Laserjet driver, among others.

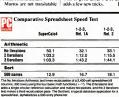


Perspective Version 1.0 3D Software Inc. 860 Via de la Paz Pacífic Palisades, CA 90272 (213) 459-8525 List Prices \$295; Version 2.0 with EGA cotor and laser printer support, \$349 (available full

1986)
Requires: Hercules monochrome graphics card, monochrome monitor.
In Short: A powerful tool for

creating 3-D graphs that won't overwhelm occasional users. Not copy protected. CIPCLE 422 ON READER SERVICE CARD

1-2-3 does single revolvabitions faster, but with multiple passes (to account for circular references), SuperCulc4 comes out about. SuperCulc4's doubuse sort is faster.



Turbo Cards: Cheap, Fast **But No Panacea for PCs**

HANDS ON

BY VINCENT PUGLIA

Even as our cover story (see "Accelerator Boards: Power for a Price," page 125) went to press, accelerator boards continued to pour in the door-including several variations on the theme. The PC aftermarket is sure that thousands of PC users want the speed of an AT without

paying the price of an AT. Among the ones reviewed here, only the Univation Dream Card is a true accelerator card. The Cheetah Combo Card/70 and the Cheetah Card/70 are really AT memory expansion boards that use 70-nanosecond chips with zero-wait technology to speed up ATs rather than PCs. The Alloy Bi-Turbo Card is being marketed as a coprocessor board. And Microsoft's MACH 10 (see below) is a bundle: a speed-up board, a mouse, and Microsoft Windows.

Because of time constraints, these Hands-On First Looks could not include the usual full range of PC Magazine Labs performance tests.

Alloy Bi-Turbo

Like the Orchid PCTurbo 286e (see cover story), Alloy's Ri-Turbo board offers more than acceleration. A full-length tandem board running an 8-MHz NEC V20, the Bi-Turbo comes with I megabyte of RAM, an RS-232C serial port, and coprocessing software. The software allows you to run two tasks simultaneously, create a spooler, lock out users from specific drives, and send messages across tasks. An 8087 math coprocessor is an option.

You execute programs as you would normally, switching between modes with a "hot key." Another key sequence enables you to access coprocessing features from within your applications. The Orchid board tended to

the-shelf software. The Bi-Turbo card avoids these problems by allocating the drives as shared and nonshared devices. If shared, both modes have full read-and-write access: if not. only one mode can write to the

The PC Labs benchmark tests demonstrated that the Allov card can race through many tasks, especially those involving video output. They also raised a question about the board's design because speed increases for the same tests varied widely. Usually, but not always, the variations depended was in the foreground or the background, with the faster times showing up in the background. The greatest variations, though, were during the video tests. A test of the Bi-Turbo's ability to scroll text swung from

a half-second to 11/2 seconds. The Bi-Turbo card has a few other problems with video-especially when running applications such as 1-2-3, which write directly to the screen. Although each mode receives its own fullscreen display, information still spills over from one screen to the other. We found it impossible to hot key from the host

mode to the turbo mode while running a test program that blitzes the sereen with snow.

Univation Dream Card

The basic Univation Dream Card includes a 10-MHz 8086 I megabyte of 150-nanosecond RAM, and software for creating switching from turbo to PC mode, creating RAMdisks and print spoolers, and copying ROM into the faster memory. Its modular design allows you to add another megabyte of RAM and either a parallel/serial/clock board or a serial/serial/clock board. A slot accommodates an optional 10-MHz 8087.

Speed increases are modest with the Dream Card. Most of the PC Labs benchmark tests. including the 1-2-3 macro, showed improvements from two to almost three times over that of a standard PC. You

(continued on page 38)

Benchmark Tests: Accelerator Boards Floating-1.2.3 Screen Composite display MOP 8087 Normal PC or XT 100 100 100 100 100 4 89 6-MHz PC AT 4.56 MACH 10 2.74 Dream Board 48 99 2.36 Alloy Bi-Turbo N/A Cheetah (8-MHz AT) 30 41 3.35

Table compares relative speed of accelerator boards to a PC or XT. Lence numbers indicate faster operation. The time a PC pikes to complete benchmark is set to 100 (except 8087 test, in seconds). For explanation of tests, see page 164.

Microsoft MACH 10: Speed for Windows

HANDS ON

N A---Not annivable

BY CHARLES PETZOLD Let's say you want to put Micro-

soft Windows on your PC or XT. You'll need the Windows program, of course. A mouse would be nice, too, And, of course, you'll probably want to buy an AT because everyone knows Windows is too slow on 8088 machines.

Wait just a minute-Microsoft has an alternative. Its new MACH 10 accelerator

board includes a mouse port, a mouse, and Windows for \$549. Since Windows lists for \$99 ar.J a bus mouse costs \$175, \$549 is actually a good price.

9.54-MHz 8086

The full-length MACH 10 board is built around an 8086 microprocessor clocked at 9.54

MHz (double the normal PC and XT speed) and 8K bytes of highspeed memory used for memory caching.

Conservative Timing

You can switch between high-speed mode and an 8088 emulation mode by a switch box that connects by cable to the back of the board and lights up when running at high speed. The 8088 emulation mode simply disables the cache and will actually run somewhat faster or slower than your normal machine, depending on what it's doing.

Major Database features for a minor price!



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TAS+

Before you buy DBase III, QuickCode and Clipper, look at TAS-Plus

TAS-Plus just made it faster, easier and cheaper to build database applications. TAS-Plus combines the power of a Relational Database with the ease of a Program Generator. Then TAS-Plus adds a Runtime Comoller to produce

lightning-fast finished code. Look at what TAS-Plus gives you:

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TAS-Plus gives you power where it counts. You can store up to 65,000 records, open up to 16 files at a time and enter up to 10,000 characters per record. TAS-Plus even reads your old DBase files.



TAS-Plus writes the program

for you
With TAS-Plus, you can start building
professional database applications on
day one. Just "paint" the screen the
way you want and TAS-Plus writes the
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program for you. You can even paint using different colors or graphic characters. And custom reports are just

characters. And custom reports are just as easy. TAS-Plus has over 86 commands and 200 options available in its Source Code Editor, so you won't run out of room to

Easy to use features

grow.

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Browse through your database and see multiple records on the screen at the same time.

same time.

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price, at \$69 it's awesome.

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Toshiba T1100 Plus: The Laptop of Choice

HANDS ON

BY BILL WONG Looking for the best battery-Haves-compatible modem powered, PC-compatible laptop? Toshiba's \$1,999 T1100

Plus may just fit the bill. Toshiba took to heart the suggestions that PC Magazine made about the 9-month-old T1100 in "DOS to Travel" (Volume 5 Number 13). Where, the T1100 was the least flawed of the nine machines surveyed (we declined to make any of them an Editor's Choice), the T1100 Plus can be recommended with no qualms.

Still Under 10 Pounds

Best of all, the new model is only slightly beftier than its predecessor, weighing in at a svelte 9.9 pounds. And Toshiba packed several significant improvements into the new box: · It replaced the keyboard layout with a more sensible one: function keys and number keys

switch between modes by run-

ning a utility or toggling a

switch on the rear, or using a hot

key. The last method is not al-

boards reviewed in the cover

story, the Dream Card has prob-

lems enabling the 8087 excep-

tion interrupt (see cover story

for further explanation). The

daughterboard memory can be

designated as expanded memo-

While the Cheetah Cards are

AT memory cards with 512K

bytes to 2.5 megabytes of RAM

(the Combo Card/70 adds a seri-

al port), they provide speed

gains on par with accelerator

installing either Cheetah board

If you have a 512K-byte AT,

The Cheetah Cards

Like many of the other

Turbo Roards

(continued from page 36)

ways successful.

separate rows across the top It added a second 3½-inch. microfloppy disk drive . It speeded up the optional

(\$399) from 300 to 1200 baud. Sterling Features Toshiba also added a battery-

backed clock, a carrying han-ACT

Toshiba Information Systems 2522 Chambers Rd . #210 Tustin CA 92680 (800) 457-7777 (714) 730-5000

List Price: With 256K, \$1,999; with 640K, \$2,399; 384K mem ory card (for 256K T1100 Plus), \$499; internal 300/1200-bps Hayes-compatible modern, \$399; expansion chassis interface card, \$199; expansion

involves disabling the second bank of 256K bytes. You're out \$40 (the street value of 256K these days), but the price is

worth the increase in performance. The benchmarks showed an increase of up to 90 percent relative to a 6-MHz AT and an approximately 20 percent increase over the new 8-MH+ AT

Part of the speed increase occurs because of the speed of the memory chips-70 nanoseconds instead of the AT's 150 nanoseconds. The rest happens because the card runs with zero wait states.

No Free Lunch

As with the other accelerator cards reviewed in this issue, the speed gains don't completely outweigh the hassles. If you have a PC or an XT and really want the speed of an AT, you may have to bite the bullet and buy an AT.

dle, and a 16-bit 80C86 processor running at a keyboard-selectable 4.77 or 7.16 MHz. The built-in battery lasts

up to 8 hours. Between the T1100 Plus and its killer T3100 (the \$4,499 AConly 15-pounder with an 80286. plasma display, and a hard disk). Toshiba has suddenly be-

come the king of the laptops. [2]

rein with five IBM-c

ble slots, \$999; external 51/4inch disk drive. \$499: floony link (controls 51/4-inch of desktop PC), \$199; 12-volt automobile power adapter, \$29; carrying case, \$49

In Short: A 10-pound LCDscreen laptop that runs programs up to twice as fast as IBM's PC

Convertible. The best choice among laptops. CIRCLE 423 ON READER SERVICE CARD MACH 10

(continued from page 36)

The mouse port uses Microsoft's new one-chip "in-port device interface." The board works very well and makes using Windows more of a pleasure than on a straight PC or XT.



MACH 10 Microsoft Corp

16011 NE 36th Way P.O. Box 97017 Redmond WA 98073 (800) 426-9400 (206) 882-8080 List Price: \$549 Requires: IBM PC. XT. or

Portable PC. In Short: Bundled with Microsoft Windows and a mouse, this accelerator board for the PC or XT may be an easy route to getting Windows running without suffering too much from the notorious speed problems. Naturally, it speeds up other pro-

grams, too. CIRCLE 448 ON READER SERVICE CARD

FACT FILE

Alloy Computer Products Inc. 100 Pennsylvania Ave. Framingham, MA 01701 (617) 875-6100 List Price: Basic card, \$995: Math 16, \$295 Requires: 64K RAM, IBM PC compatible, hard disk drive.

CIRCLE 441 ON READER SERVICE CARD Cheetah Combo Card/70 Cheetah Card/70

Cheetah 107 Community Blvd., #5 Longview, TX 75602 (800) 243-3824 (214) 757-3001 List Price: Combo Card/70 (1.5 Mbytes), \$1,775; Cheetah Card/70 (2.5 Mbytes), \$2,295 Requires: 256K RAM, 8-MHz IBM PC AT or compatible CRCLE 442 ON READER SERVICE CARD

University 1037 N. Fair Oaks Ave.

Sunnyvale, CA 94089 (408) 745-0180 List Price: Basic card, \$512; with EMS, \$795; with t Mbyte of t50-nanosecond RAM. \$995; with 2 Mbytes, \$1,395; with EMS and multifunction \$995; with I Mbyte, EMS, and multifunction, \$1,195; with 2 Mbytes, EMS, and multifunc-

tion, \$1,595. Requires: Floppy disk drive, IBM PC. XT or compatible. In Short: The Dream Board offers a 10-MHz 8086. CRCLE 443 ON READER SERVICE CARD

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■ NEW ON THE MARKET ■ PAUL M. STAFFORD

Communications Software, Hardware Increase Flexibility for Users VM Personal Computing and

VM Personal Computing and System Design Associates (SDA) aim to increase communications flexibility for users with enhanced software, while EKD Computer Sales offers hardware that lets authorized users power up a remote PC from over the phone.

from over the phone.

'Wh'' s Refay Silver is a lowcost (\$150) version of its \$225
Relay Gold software. Like Relay Gold. Relay Silver supports
language and DEC VT-100
minicomputer terminal emittion. Unlike Relay Gold, however, Relay Silver does not support mainframe terminal emulation.

emulation.

SDA's \$79.95 RamNet manages scripted communications tasks in the background, letting foreground programs run undisturbed.

A user of EKD's \$29 Teleswich pluss a PC and modern into its AC outlet and the Teleswich into the wall. When a call comes in on the data line, the Teleswitch answers the phone and turns on the power to the PC and modern. The user then hangs up and calls back within 1 to 5 minutes, enters a password, and goes into a remore communications software package that has been preset for remote access.

List Price: Relay Silver, \$150. Requires: 256K RAM. VM Personal Computing, 41 Kenosia Ave., Danbury, CT 06810; (800) 222-VMPC; (203) 798-3800.

CIRCLE 436 ON READER SERVICE CARD List Price: RamNet, \$79.95. Requires: 64K RAM. System Design Associates, 594.3rd Ave...

Design Associates, 594 3rd Ave., New York, NY 10016; (212) 889-6431.

CIRCLE 431 ON READER SERVICE CARD

List Price: Teleswitch, \$229, EKD Computer Sales and Supplies Corp., 764 Middle Country Rd., Selden, NY 11784; (516) 736-

CIRCLE 432 ON READER SERVICE CARD

IBM, Panasonic Scanners Signal Support for Desktop Publishing Market

Publishing Market In bids to get in on the incipient desktop publishing market, IBM and Panasonic have unleashed three image scanners

leashed three image scanners. 1BM's scanners, the \$1,095 3117 and the \$2,350 3118, each have maximum resolutions of 240 by 240 pixels and scan at an

average scanning speed of 12 seconds per page, IBM claims. The 3117 is a flatbed design that accepts thick or irregularly

accepts thick or irregularly shaped objects, while the 3118 is a sheet-fed unit that accepts up to standard legal-size documents.

The Panasonic Image Scanner is a flatbed unit that scans up to 16 shades of gray in up to 400-dot-per-inch resolution and costs under \$2,000.

costs under \$2,000.
List Price: IBM 3117, \$1,095;
3118, \$2,350. For more
information call your local IBM
dealer.

CIPICLE 437 ON READER SERVICE CARD List Price: Panasonic Image Scanner, price to be announced. Panasonic Industrial Co., One Panasonic Way, Secucus, NJ 07094: (201) 384-7000.

CIRCLE 438 ON READER SERVICE CARD

HOT PROSPECT

Bowker Enters CD-ROM Arena with Reference Works, OCS Finds Mark with 8-Unit CD-ROM Drive Controller

Bowker Electronic Publishing, a spinoff of library reference book giant R. R. Bowker, hus made a big splash in the CD-ROM market with the release of Books in Print (BIP) Plus and Ulrich's Plus, as well as Online Computer Systems' (OCS) CD-ROM controller card capable of integrating

up to eight CD-ROM drives. BIP Plus (5895 yearly, including quarterly updates) and Ulrich's Plus (\$395 yearly, including quarterly updates) come on single 4.72-inch compact laserdisks, replacing 16 bound volumes of book and periodical references. Both include a search engine that supports full Boolean logic, up to 15 search parameters at a time. and can store and recall previous searches. Bowker plans to market the search engine separately as an original equipment manufacturer (OEM) product.

er (OEM) product.
OCS's CDI-110 control-ler card, shown at the
Bowker press conference,
can handle up to eight Sony
or four Hitachi CD-ROM
drives, either as separate
volumes or as a single integrated volume.

List Price: BIP Plus, \$895 yearly; Ulrich's Plus, \$395 yearly. Bowker Electrom: Publishing Inc., 205 E, 42nd St., New York, NY 10017: (212) 916-1600.

List Price: CDI-t10, \$350; with 256K RAM, \$550. Online Computer Systems Inc., 20251 Century Blvd., Germantown, MD 20874: (800) 922-9204:

and can store and recall greevious searches. Bowler plans to market the search plans to market the search model and a property of the search plans to market the search model and a property of the search plans to market the search model and a property of the search plans to the search

Wyse Businessland Debut 10-MHz AT: Philips. Compu-

terLand Show Compatibles
Just as department stores sell
house-brand merchandise
alongside famous-maker labels,
two of the biggest computer retailers now have private-label
PCs. Also out are new PC and
AT compatibles from Wyse
Technology and Philips.

Wyse Technologies' 52,499
WYSEpc is an 80286-based AT
compatible hat runs at users-electable clock speeds of 6 or 10
MHz. compared with the MPC
AT's 8 MHz. The base
WYSEpc features 640K bytes of RAM, a 1.2-megabyte floppy disk drive, and either an ATor enhanced-style keyboard. The
WYSEpc is also being marketed under private label by the
Busnessland retail chain.

12- to 24-ppm Print Engines Drive Laser Printers from Toshiba, OMS. Hanzon

With a plethora of laser print engines now available, printer manufacturers are releasing muscular laser printers at a terrific pace. The latest entries to hit the market hail from Toshiba. QMS, and Hanzon

Data.
Toshiba's \$3,495 PageLaser
12. featuring Toshiba's print
engine, prints 300- by 3(X)-dotper-inch (dpi) resolution text
and graphics at 12 pages per
minute (ppm). Emulating sever-



ComputerLand's Business Computing System (BCS) is unique in that its base unit consists only of a chassis, a power supply, an eight-slot system bus, and a keyboard. Fitted with a two-slot 8088-2 system board (4.77 and 8 MHz), 256K bytes of RAM, and a dual-floppy adapter, the BCS becomes the BC88 and sells for \$1,495. With a three-slot 80286-2 processor (6 and 8 MHz), 512K bytes of RAM, and dual-floppy and hard disk drive adapters you get a BC286 that retails for

\$2.895 Philips Information Systems has launched two machines: the \$1,752 P3102 and the \$3,795 P3200. The P3102 is an 8088-based unit featuring 512K bytes of RAM, a single floppy disk drive, and a monochrome graphics adapter and monitor in base configurations. The P3200 is powered by an 8-MHz 80286 processor and also features a mono/graphics display, as well as a 1,2-megabyte floppy.

List Price: WYSEpc, \$2,499. WYSE Technology, 3571 N. First St., San Jose, CA 95134; (408) 433,1000

DIRCLE 433 ON READER SERVICE CARD List Price: BC88, \$1,495; BC286, \$2,895. Check telephone book for local ComputerLand address and phone number.

CIRCLE 434 ON READER SERVICE CARD List Price: P3102, \$1,752; P3200. \$3,795. Philips Information Systems, 15301 Dallas Pkwy. #300, LB 35, Dallas, TX 75248; (214) 980-2000

CIRCLE 435 ON READER SERVICE CARD

Microrim Debuts R:base System V to Compete with Multiuser dBASE III Plus

In a bid to leapfrog Ashton-Tate's dBASE III Plus. Microrim has announced R:base System V-a \$700 multiuser advance on its R:base 5000 database management system.

R:base System V can function as either a standalone or networked database manager. Other enhancements to R:base 5000 include expansion of its "Express" technology. R:base 5000's claim to fame was its Applications Express, a menudriven applications generator. R:base System V also includes Forms Express and Reports Express, which let users easily create data entry forms and custom reports that they can print to screen for previewing. Also new is a Notes datatype, so users can append up to 4,092 characters of text to their records.

Multiuser features such as automatic tabling and locking and row verification regulate simultaneous file access. R:base System V is not copy protected. R:base 5000 continues to be

available. The price has been cut from \$700 to \$495. List Price: \$700 (uperade from R-base 5000, \$99). Requires: 512K RAM, hard disk drive Microrim Inc., 3925 159th Ave. NE, Redmond, WA 98052; (206) 885,2000

CIRCLE 436 ON READER SERVICE CARD



print engine. The 300- by 300-

dpi, 8-ppm unit features 512K

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Microron's \$700 R:base System V is a multisurer DBMS that improves on R:base 5000 by including form and report generators, as well as an applications generator.

al popular dot matrix printers, including units from Diablo. Toshiba, and Epson (and the Hewlett-Packard Laserjet+) through an optional cartridge, the PageLaser 12 features 512K bytes of RAM and a claimed duty cycle of 10 years at 5,000 pages per month.

QMS unveiled four strong entries at the National Computer Conference in Las Vegas, Nev.: the \$11,995 Lasergrafix 1500 (Ricoh-driven, 15 ppm, 3 megabytes of RAM, and 12 resident fonts), the \$29,995 QMS-PS 2400 (Xerox-driven, 24 ppm, 3 megabytes of RAM, 13 resident fonts, and PostScript page-description language support), the

\$6,995 Smartwriter 150 (Ricohdriven, 15 ppm, and 19 resident fonts), and the \$8,995 Smartscript 800 (Canon-driven, 8 ppm, 17 resident fonts, and PostScript Hanzon's \$3,980 LP-3000

Toshiba's \$3,495 PageLaser 12 lets users select antions from a control panel that features Englishlanemare diagnostics and fredback



feeder.

laser printer is driven by a Ricoh List Price: PageLaser 12, \$3,495. Toshiba America Inc., Information Systems Div., 2441 Michelle Dr., bytes of RAM, six standard Tustin, CA 92680: (714) 730-5000. fonts, and a 250-sheet sheet CIRCLE 427 ON READER SERVICE CARD

List Price: Lusergrafix 1500, \$11,995; OMS-PS 2400, \$29,995; Smartwriter 150 56 995 Smartscript 800, \$8,995, OMS Inc., P.O. Box 81250, Mobile, AL 36689: (205) 633-4300.

CIRCLE 428 ON READER SERVICE CARD List Price: LP-3000, \$3,980. Hanzon Data Inc., 18732 142nd Ave. NE. Woodinville, WA 98072: (206) 487-1717

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Microsoft Gets Serious With QuickBASIC 2.0



A \$99 BASIC with the clout to challenge Turbo Pascal.

BY CHARLES PETZOLD

With Microsoft's new Quick-BASIC 2.0 compiler, BASIC has suddenly acquired a whole new look and appeal. While sprucing up the outside with an integrated full-screen editor, inmemory compiler, and intelligent debugger, Microsoft has also added significant language enhancements that make true structured programming and modularity a breeze in BASIC programs. With the \$99 list price, QuickBASIC 2.0 now competes head-on with Borland's Turbo Pascal-and in

many ways comes out ahead. The full-screen editor and pull-down menus in QuickBA-SIC 2.0 will be familiar to anyone who has worked with Microsoft Windows, but the QuickBASIC editor runs in character mode and is very fast. It will use 43 lines on an Enhanced Graphics Adapter if you enter the program in 43-line mode. A mouse makes the editor easier to use but is optional because keyboard commands duplicate all mouse functions.

Two Compile Options

A menu option lets you compile either to disk (for standalone .EXE programs) or to memory. The compilation is speedy enough to make preliminary development under the BASICA interpreter unnecessary. Any errors found during compilation will jump you back into the editor. Unlike Turbo Pascal, however, QuickBASIC 2.0 finds up to 25 errors (instead of just the first) and lets you fix



For \$99, you get a sophisticated programming language that is easy to use.

them all in the editor with a Find Next Error command. And OuickBASIC also handles runtime errors with more grace than Turbo Pascal does

QuickBASIC 2 0 also includes a sophisticated run-time debugging mode. When you set "trace" on with the TRON statement, the screen solits in two with your source code on the bottom. You can single-step

activate a dual-speed "animate" mode where a reversevideo bar bounces around your source statements as the program output appears on the top part of the screen. To the language itself, Mi-

crosoft has added multiline IF-THEN-ELSE and DEF FN statements, as well as subroutine calls with replaceable parameters and local variables. Although these structured con-

or trace through source code, or Why Pay for BASIC?

Since every user gets BASIC at no cost with his system, why drop a hundred bucks on this one? Old-fashioned free interpretive BA-SIC is terrific for banging out quick-and-dirty programs. But critics have universally dismissed it as a nonserious programming language, and they're mostly right. The interpretive dialect runs at a crawl, can't do some important tricks, and

encourages spaghetti-like BASIC compilers have been around for years-but this one's different. It lets you jump around by using labels rather than line numbers. Its full-screen editor

program logic.

isn't the best around, but it's miles above its predecessor's pathetic line editor. Its many debugging abilities are awesome. It handles the FGA DOS and BIOS calls local variables, and much more without flinching. And it beefs up many of BASIC's anemic commands

BASIC compilers have always been able to speed up your programs and keep your source code from prying eyes. This one is head and shoulders above the crowd, since it also makes writing and debugging your programs a dream. Whether you use BASIC as a serious business tool or just fool

around, it'll be the best \$99 you ever spent. -Paul Somerson

FACT

OulckBASIC 2.0 Microsoft Corp. 16011 NE 36th Way Box 97017

Redmond, WA 98073 (900) 426-9400 (206) 882-8080 List Price: \$99 (\$30 for undate

from OnickBASIC 1) Requires: 256K available memory, MS-DOS or PC-DOS

2.0 or later In Short: QuickBASIC 2.0 turns BASIC into a serious, structured programming language with significant improvements over the interpretive version bundled with most computers.

CIRCLE 447 ON READER SERVICE CARD structs now make the old GOTO and GOSUB completely unnecessary, the older commands are still included for compatibility. Line numbers are not required. and you can branch to alphanu-

meric labels. The BASIC graphics functions support all the graphics modes of the EGA. You can store BASIC or assembly language subroutines in a user library and link them with your programs. As an example of this process, the QuickBA-SIC 2.0 disks include routines that let you make DOS or BIOS

your BASIC programs. Programmers who don't want to bother with the built-in editor and debugging features can compile normally by running QuickBASIC with command line parameters. A 600nage manual consolidates all compiler and language informa-

software-interrupt calls from

What About Windows?

The only disappointing asnect of QuickBASIC 2.0 is that it is not a version of BASIC for Microsoft Windows. Although QuickBASIC 2.0 may look and feel a lot like Windows, it really has nothing to do with it. The OuickBASIC 2.0 package does not even include a .PIF file to let you run it as an "old applica-

tion" within Windows.



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A review of the IBM Personal Computer Family, Vol. 3, No. 1

Welcome To Read Only.

Here's great news for IBM PC users. IBM has expanded its already expansive PC product line to bring even more power and flexibility to your desktop.

In this issue alone you'll be reading about new enhancements to the IBM PC/XT, the IBM Personal Computer AT,* the IBM PC Keyboard, the IBM Proprinter, the Mainframe

Communications Assistant, and more. And, as if that weren't enough,

IBM has also found time to expand your computing horizons even more by introducing exciting new PC products. This issue of Read Only will tell you about the new IBM PC

Convertible, new 3.5" diskettes, the new IBM PC 3.5" External Diskette Drive, and two new accounting software packages,



HARDWARE NEWS

The Right Touch.

To make it easier than ever to work at an IBM PC/XT or Personal Computer AT, IBM has introduced the new IBM Enhanced Personal Computer Keyboard (shown below).

IBM redesigned its classic keyboard to better meet the needs of PC users, office system users, as well as users who communicate with larger computers.

To accomplish this, IBM included separate cursor and screen control keys, making it easier for users to dedicate the numeric keypad to numeric input when working with number-intense applications. Plus, the keypad can still be used for cursor and screen control when not in the num/lock mode.

IBM also increased the number of function keys from ten to twelve, arranged across the top of the keyboard. This gives users two additional keys for increased automatic operation.

All to enhance the productivity of those who work with words, numbers

Two Ctrl and Alt keys for ambidexor a host of other applications. trous access, Twelve Function keys in new positis Isolated Escape key two additional to help reduce Function keys pro-vide added flexibility Dedicated Function keying errors. and Shift keys. Control keys for in host access or frequently used communications Enlarged Tab and applications. Dedicated Numeric Caps Lock keys. Pad including Enter key and four Arithmetic Function keys for easy meric input. Separate Screen Control and Cursor keys for faster easier access The IBM Enhanced PC Keyboard to help you be more productive, faster.

Small Wonder

Proof positive that good things come in small packages is the new 3.5-inch diskette.

And that's big news for anyone who uses an appropriately configured IBM PC, PC/XT, Personal Computer AT and the new IBM PC Convertible.

Durable 3.5" diskettes, allow you to carry over 350 standard typed pages (720KB) in your shirt pocket. That's twice as much information as on a 5.25" (360KB) diskette, in a much more rugged, portable form.





The new 3.5" diskette stores up to twice as much (720 KB) as a 5.25" (360KB) diskette.

Now IBM PC users have the option of using programs and data in either size, and the flexibility to work with other members of the IBM PC family using 3.5" diskettes.

Translation Services. The new IBM Personal Computer

3.5" External Diskette Drive provides a vital bridge between your IBM PC and 3.5" technology. This compact unit makes it easy for you to share information between 2.5"

computers using 3.5" diskettes and 5.25" diskettes.

The IBM PC 3.5"
External Diskette Drive
provides a cost-effective bridge
between 3.5" and 5.25" technology.



The new IBM PC Convertible is a fi

The IBM Personal Computer 3.5" External Diskette Drive comes in two models, one for the IBM Personal Computer AT and one for the IBM PC, PC/XT or IBM PC Convertible.

Information and applications can be shared* between 3.5" diskette drive machines and an IBM PC running DOS 3.2 with the IBM Personal Computer 3.5" External Diskette Drive attached.

Diskette Drive attached. Transferring files and programs between 3.5" and 5.25" diskettes is a casy as making a backup copy of a diskette. So, you can very quickly have a "database to go" for your IBM PC Convertible. Or, a week's worth of sales call information in a ready-to-use form for your secretary when you return.

Print Evolution.

The new IBM Proprinter XL is especially designed to make life easier for those who work with accounting applications. Its wide carriage design and switchable printing speeds of up to 200cps are perfectly suited for spreadsheet applications.

The IBM Proprinter XL also features an easy-to-use front operator panel that lets you choose from the XL's extensive menu of features, even if you have little or no programming skills.

Plus, the new Proprinter XL offers a long list of standard, labor-saving features to make many printing jobs easier, easy printing of single sheets and envelopes without removing your continuous forms paper, power-assisted paper loading, all-points-addressable graphies capabilities, near-letter-quality printing (40cps), and emphasized text printing (100cps). Plus, you can set the printer in double high, double wide or emphasized print through the operator panel or through software.

Power To Co.

The new IBM PC Convertible can play two powerful roles in any businessperson's life.

In the office, with an optional IBM PC monochrome or color display and adapter, the PC Convertible fills the bill as a space-saving desktop PC.

But when you're ready to hit the road or runway, just attach the high quality, 80-column x 25-line detachable LCD display, and the PC

Convertible is ready to travel, too.
Weighing in at a scant 12 pounds,
the IBM PC Convertible delivers
full-size PC performance in a portable
computer with heavyweight features
including:

A full-function keyboard with fullsize keys and the same center-tocenter key spacing as a standard IBM PC keyboard. A fast, very efficient 80C88 micro-

processor with up to 10 hours of non-stop computing power between battery recharges (with average use).

hattery recharges (with average use) Up to 512KB of user storage (through 128KB expansion cards from a standard 256KB).

Dual 3.5" diskette drives supporting 720KB capacity 3.5" diskettes.

Additional IBM PC Convertible features help ensure that work done on the road doesn't get lost in transit.



power PC that works wherever you do.

These optional features include: An internal modem feature to let

you communicate with other computers simply by plugging the PC Convertible into any standard modular phone outlet.

The IBM PC Convertible Printer for system battery powered, near-letterquality printing anywhere. Plus, the IBM PC Convertible can

come with a helpful set of programs to get you up and running on the road to enhanced productivity. Fast.

Planned For Growth.

It's a classic case of a very good thing that just keeps getting better. IBM has now the

IBM has now introduced the enhanced PC/XT product family: increased flexibility in storage, memory and option configuration for maximum productivity today, and



The new IBM PC/XT—enhanced power and flexibility for today. And tomorrow.



plenty of room to expand as your business does.

The XT is now available with a 20-megabyte hard file that can store up to 10,000 pages of information. There's also an easy, low cost way to increase memory to a full 640R ion the system board without tying up valuable expansion slots. And the XT now has 3.5" diskette capability, utilizing the new IBM Personal Computer 3.5" External Diskette Drive.

Plus, full IBM PC compatibility means that no matter which XT model you choose, you can benefit from the extensive IBM Personal Computer software library.

The new IBM PC/XTs, because one size should not have to fit all.

Power Play.

If you thought you'd seen all the IBM Personal Computer AT has to offer, think again. Twice.

IBM has increased processor speed in two new models of the IBM Personal Computer AT by an impressive 33% (from 6mhz to 8mhz). So, they're sure to become your fast friends if you work with large spreadsheets and yolumes of data.

The new models offer a standard 30MB hard file and the option to add an additional 20MB or 30MB hard file. That's a grand total of 60MB, or approximately 30,000 pages of words and numbers.

These two newcomers are born communicators: Sharing files with other PCs from a variety of popular software programs. Working as a server for data storage and file processing in an IBM PC LAN running

the IBM PC Local Area Network program. Utilizing IBM TopView™ and one of the IBM PC 3270 Emulation Programs to access mainframe information and to execute PC DOS and mainframe applications concurrently.

And the best news of all is that you can get all this increased power without an



Now the IBM Personal Computer AT offers a choice of hard files to meet

your storage needs.



Meet Your New Assistant.

Keeping the books for a small business is a very big job. So, IBM thought you could use a friendly, versatile, highly skilled assistant. The new IBM Accounting Assistant Series.

This complete series of automated bookkeeping application programs for small to medium size businesses can help cut any job down to size. And, its modular design means that you can start out with just the programs you need today, then expans your series as your business grows.

The IBM Accounting Assistant Series includes six individual editions: General Accounting, Accounts Payable, Accounts Receivable and Billing, Payroll, Inventory



The IBM Accounting Assistant Series. Big help for small to medium size businesses.

Control and Purchasing, and Job Cost bidding software.

Plus, thanks to the IBM Accounting Assistant Series' user-friendly attributes and easy-to-follow instructions, you can start profiting from your system from day one.

High-Powered Advice.

Perhaps your husiness has progressed past the need for basic accounting software. Then you should consider getting powerful, sophisticated help: the IBM Business Advisor.

IBM Business Advisor PC accounting software takes integrated software to a new level of sophistication and ease-of-use.

Business Advisor's seamless architecture allows functions from each of its modules to play together. Passage back and forth among the General Accounting, Accounts Papable, Accounts Receivable, Payroll, Inventory Control, Order Entry and other applications is intuitive. Menus guide you easily from one task to another.

And when you make a change anywhere, consider it made everywhere it applies. Automatically, through Business Advisor's real-time posting feature.

This Business Advisor speaks your language, too. It uses business language instead of accounting language, and has over 80 easily customized financial report formats built in. And you don't have to keep this all to yourself, because in an IBM LAN

different people at different PCs can work on the same file at the same time.

And you always go further when everyone is working together.



The 3270 Enulation Programs, Entry Level, Version 2 and Version 3, give you an easy and inexpensive way to attach your IBM PC to your host computer.

Working at your IBM PC, standalone or in an IBM LAN, you can now utilize the local power and userfriendly attributes of your PC for DOS applications, plus have access to the vast memory, number-erunching capacities and other productivityenhancing capabilities of your host computer.

The Entry Level product offers up to 40% faster file transfer between your



IBM PC 3270 Emulation
Products can put your IBM PC or IBM
LAN in touch with the big time.

PC and host computer. A "Hot Key" for easy switching between host and PC applications. Keyboard remapping so you can always work in a familiar keyboard format. And much more. Versions 2 and 3 can provide an economical gateway which lets you share the wealth of host knowledge with the members of your IBM PC Network or Token-Ring Network.

Versions 2 and 3 support the new PC DOS 3.2, 3.5" media, the IBM Local Area Network program 1.10, a host of printers and the TopView 1.1 interface, for multitasking and windowing capabilities.

All of which adds up to added productivity for you and everyone on your IBM Local Area Network or token ring.

To find out more about the entire family of 3270 PC Emulation Programs, as well as a wide range of other IBM connectivity hardware and software, watch for the next Read Only.

Mainframe Communications Assistant enhancements include 3.5" media support and increased IBM PC family communications capabilities.

The IBM PC Voice Communications Option speaks for itself. This multifunction adapter card can allow your IBM PC to recognize and respond to voice commands, speak text that appears on the screen, initiate and receive/record/playback phone calls, provide remote, tone push button phone access to your PC (and host), and transmit voice and data simultaneously.

For more information on any of the Personal Computer products discussed in this issue of Read Only, see your Authorized IBM Personal Computer Deuler, Or, call 800-447-4700, In Alaska call 800-447-6890,

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PROBLEM: The more experience your hard disk has, the harder it has to work.

THE SOFTLOGIC SOLUTION: Disk Optimizer™

Your hard disk will run faster when it's not chasing around after files.

Remember the old days when your hard drive was new? Remember that smooth, fast,

slick performance? Those quick retrievals, rapid saves, lightning-like database sorts? Well ever since, DOS has been doing its best to slow your hard drive down. Not by slowing down the motor, but by breaking your files up into pieces. Storing different chunks in different places. Data files, programs, over-lays and batches that started out in one seamless piece are now

PERCENT PRAGMENTATION

scattered all over. Loading is slower. Sorting is slower. Retrieving, backing-up.

Everything takes longer because your disk has to work harder. Problem is, it's something that happens so ually you may not notice the difference.

At least, not until you see the dramatic improvement after using Disk Optimizer. File fragmentation—It's a problem

you can see.

Watch your hard drive the next time it reads or writes a file. Each "blip" of the LED means the drive-head is moving to another place on the disk-either to pick up or lay down another chunk of data. And the truth is, head movement takes

time. Far more time than actual reading and writing. What's worse, all this head moveent causes extra wear and tear that can shorten the life of your drive.

Disk Optimizer-Tunes up your disk by cleaning up your files.

Disk Optimizer works by finding all the scattered pieces of your files and putting them. back together where they belong. Next time your drive reads it, there's just one place

And the results are often dramatic. Reading and writing times may be cut by as much as two thirds. Database sorts that used to take hundreds of head wes now proceed quickly and efficiently. And since head move-

ment is now at an absolute minimum, your disk drive will lead a longer, more productive life.

Analyze, scrutinize, optimize.

Before you optimize, you'll probably The more fragmented your files get, the longe they take to reprieve want to analyze. So Disk Optimizer shows you, in percentages, how much fragmentation has taken place—on the entire disk, in individual

directories, or for groups of files you specify using global or wildcard names. Plus, there's built-in data security that lets you assign swords to as many files or

file groups as you want. And the File Peeker gives you an inside look at the structure of files. It's a great way for non-programmers to learn more about computers, and a powerful tool for professionals who want to

analyze the contents of their Get your hard drive back in shape—at a special low price.

When you think about it, it's simple. The longer you

own your hard drive, the more you come to depend on it. But the longer you wait to get Disk Optimizer, the less performance you'll

And the less chance you'll have to buy Disk Optimizer at the special introductory price of just \$49.95*

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Ask for Disk Optimizer at your computer

dealer.

Or order today by calling SoftLogic Solutions at 800-272-9900 (603-627-9900 in NH), or send the coupon below Special combination pricing is available when you buy Disk Optimizer along with other SoftLogic products like DoubleDOS,

Software Carousel and Cubit. Ask for details.

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WHO WANTS YESTERDAY'S PAPERS?

How long has it been since you actually used you computer paint program? Have you used it for more than a couple of hours? Is it just taking up space on your hard disk or stashed away with your other unused diskettes? How many times have you read the "hype" or watched a slick demo on a new or improved paint program and paid good money for it only to find that it fell far short of you expectations and nothing like the manufacturer's promises At RIX Softworks, Inc. we think it's time for a change and EGA PAINT" is our answerl

You see, those other programs were originally made years ago for systems which were far more limited in their unctions and display capacity than today's computers Since then, other paint programs have simply been patched to try to keep up with the rapid growth in comster capabilities. Also, more advancements have been ade in professional drafting (CAD), spread-sheet and ith our EGA PAINT"I

Yes, EGA PAINT" is a COMPLETE toolkit for your drawing and graphics needs. Whether you are a computer artist of a businessman who has never drawn anything but doodles on a notepad. If you're looking for the best presentation possible, EGA PAINT" is your answer!

EGA PAINT" was created specifically for users of the IBM" Enhanced Graphics Adapter (or compatible). EGA PAINT" takes full advantage of every feature the new EGA. Standard offers in an extremely easy to use format. (As a matter of fact, the illustration you see above was created from a captured Lotus" screen before the user ever saw our manual!) Anyone from 6 to 60 can make dramatic, high-impact, colorful freehand graphics. flow charts, graphs, ad layouts, bar or PERT charts, schematics, etc. The only limitation is your imagination.

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included in our special introductory EGA PAINT* package EGA PAINT

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Choose from over 31 contemporary fonts ranging from 9 to 72 points in size, place them anywhere you w on the screen and in any color. Stretch or reduce them to fit: change spacing: make it light, bold, extra bold, propor donal, Italic, underlined, etc.

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Portable Printers: Laptop Companions



BY CHRISTOPHER JOHNSTON

If your laptop PC weighs 10 pounds, you don't want to lug a 20-pound printer on the road. Diconix (a Kodak subsidiary) and Laptopp Systems have both released tiny printers to comple-

ment the DOS-to-travel market.
Both use batteries or AC
power and provide adequate
speed. The Diconix Inkjet 150
measures 10% by 6½ by 2 inches
and weighs 3.5 pounds; the
OnTheGo is 11 by 4½ by 1¾

inches and weighs 2.5 pounds.

The nine-ink-jet Diconix
Inkjet 150 unit was benchmarktested in PC Magazine Labs at

69 characters per second in draft mode and 30 eps in quality mode (Diconix claims 150 and 50 eps, respectively). The OnTheGo rated at 40 eps, ambled along at 20 eps. Both are limited to 8½-inch paper. The Diconix Inkjet 150 is \$479; by comparison, Epson's FS-80 ink iet unit is \$440.

To save space, the Diconix Inkjet 150's four rechargeable Ni-Cal batteries fit in the platen. They're good for 50 minutes of continuous printing (150 pages) or 12 hours of standby power. The Inkjet 150 emulates Epson or IBM Proprinter codes. It prints italics, boldface, underline, variable spacing, the 256-

character ASCII set, interna-

tional character sets, and

FACT FILE

Diconix Inkjet 150 Diconix Inc. 3100 Research Blvd. Descon, OH 45420

Dayton, OH 45420 (800) DICONIX List Price: \$479 with Ni-Cad batteries, 62 dapter; ink jet cartridges, \$9.95 Regulres: Scrial or parallel in-

terface.

In Short: Compact ink jet printer combining light weight (3.5
pounds) with good speed (69cps draft, 30-cps quality) for the
laptop PC user on the go.

INCLE 449 ON PEADER SERVICE CAPO

bit-mapped graphics.
For \$149.95, the OnTheGo
provides adequate speed and adequate print quality. The four Ccell batteries are good for 2
hours of continuous use.

OnTheGe Laptopp Systems Inc. 515 Calle San Pablo Camarillo, CA 93010

(800) LAPTOPP List Price: \$149.95, including batteries. AC power adapter, battery protector, roll of thermal paper, \$29.95

Requires: Parallel interface cable. In Short: Small (2.5 pounds) and sturdy, it delivers 20 cps. For those who need printouts away from the office.

The print quality is readable and good for most draft applications, but the special thermal

Norton's DOS Shell: Only Name Is Special

PC HANDS ON

BY VINCENT PUGLIA With the release of The Narton Cammander, a DOS shell written by John Socha, Peter Norton is attempting to make his mark once again. This time, though, he may find universal acceptance more difficult to attain. While Commonder is slicker and easier to use than its direct competition-Bourbaki's / DIR and Westlake's Poth-Minder (see "Extending DOS's Utility," PC Magazine, Vol-ume 5 Number 9)-most of its features are found elsewhere. The ones that are relatively evolutionary may limit rather than enhance productivity.

At first glance, the Cammander's default interface, which can be customized, resembles 1 DIR's: directory listings and statistics are in separate windows, and the DOS prompt and the menu bar are on the bottom of the screen. But the resemblance

ends once you begin using Cammander. Besides being able to perform multiple file operations like Move and Delete, Cammander also includes a pop-up menu system, a point-and-shoot feature for linking nonexecutable files with relevant programs, and a WardStor-like editor.

Commonder's point-and-

shoot feature shares the same benefits and drawbacks as Poth-Minder's. Every time you point to a nonexecutable file, Commander checks a file you create called NC.EXT, associates the data file's extension with the program file, and then executes the proogram or program.

For operations that cannot be handled with a menu or the point-and-shoot feature, Commander keeps the DOS command line available. While this furnishes some solutions, it is not a final answer, since certain

DOS commands such as SET, PATH, and PROMPT can wreak havoc with the program's predefined environment

paper is expensive, smells fun-

ny, and feels like heavy gift

wrap.

Commander can be run without opening the manual, but you'll find that the documentation is necessary for setting upmenu choices and the pointand-shoot feature and learning about incompatible DOS com-

about incompatible DOS commands.



Neither better nor worse than many of the dozens of DOS shells clogging the market. The Norton Commander's most unique feature is probably its famous name. FACT

The Norton Commander
Peter Norton Computing
2210 Withine Blvd., #186-D
Santa Monica, CA 90403
(213) 826-8032
List Price: \$75
Requires: 256K RAM. Hard

disk recommended.

In Short: An adequate program for the novice who needs an easy-to-learn DOS shell, but it's not powerful or flexible

enough to attract much notice from power users. Not copy protected.

CIRCLE 484 ON READER SERVICE CAR

■ PC UPDATE ■ CHRISTOPHER JOHNSTON

IBM out the dealer price on its three base PC and AT models 1 to 17 percent the 16-b PC (236K, RAM, on floppy) disk drives, 51,959, and the heave PC AT 10 MHz, 206K, one 12 remapples floppy disk drives, 51,959, and the heave PC AT 10 MHz, 206K, one 12 remapples floppy disk heave PC AT 10 MHz, 206K, one 12 remapples floppy disk drives, 51,959, and 10 mHz, 206K, one 12 remapples floppy disk disk drives, 51,959, and 51,950, a

from Big Blue.

IBM cut list prices on its line as much as 26 percent April 2 when it introduced the 8-MHz PC AT model. Reductions were highest on hard disk PCs and ATs, least (as little as no reduction) on base ma-

chines with only floppy disk drives.

Separately, IBM altered its volume purchase agreement (VPA) policy to the benefit of both authorized dealers and corporate volume buyers. VPA customers can fulfill their obligations to buy discounted PCs and peripherals either directly from IBM or from authorized dealers—whichever offers a better deal.

Epson has initiated its own promotion for the 80286-based Equity III, cutting prices 5700 on two models for one month. The base model, with one 1.2-megabyte floppy disk drive, is now \$2.495, while one with an added 20-megabyte fixed disk is \$3.195. BMHz have 640K bytes of RAM and can toggle between 6 and 8 MHz.

Hewlett-Packard shaved \$400 off the price of its 512K-byte lap-



Hewlett-Packard reduced its Portable Plus by \$400, to \$2,995.

ment. The machine is now priced at \$2,995, with a 128K "drawer" of memory down \$100, to \$395. The 256K model is still \$2,695.

Borland International, which offered *Turbo Pascal* in two configurations, has combined both options and reduced the price. The program, which has been reduced by \$25 to \$99.95, features both binary coded decimals and support for the 8087 math coprocesser.

RoseSoft is shipping revision ten of *ProKey*, Version 4.0, (\$129.95). It supports the 101-key IBM enhanced keyboard, which allows more macros to be defined than on the 83/84 key versions.

Upgrades are \$15.

Data sharing and the ability to import and export 1-2-3 and Sym-

phony files have been added to Version 1.1 of Javelin (\$695), from Javelin Software Corp. Upgrades are \$20. Except for corporate volume buyers, Javelin Version 1.1, remains copy protected.

Compuware says Version 2.2 of its \$349 PowerBase database is 21 percent faster at retrieval, indexing, and internal sorting than Version 2.1, which was an Editor's Choice among relational databases in Project Database II (see "Relational Databases," PC Magazine, Volume 5 Number 12). Upgrades from Version 2.1 are \$25; from earlier versions. \$75.

PC Designs has added dual-processor speed to its PlaIn Vanilla PC compatible. Now the Plain Vanilla can be switched between 4.77 and 8 MHz from the keyboard. The Plain Vanilla is S995 with 4.77 and 8 MHz from the keyboard. The Plain Vanilla is S995 with 4.77 and 8 MHz from the keyboard. The Plain Vanilla is S995 with 4.77 and 8 MHz from the Vanilla is S995 with 4.77 and 8 MHz from the Vanilla is S995 with 4.77 and 4.77 and 7 and

TAT Graphics Group, which targets the CAD/CAM marketplace, has cut prices on its Galaxy graphics board and display subsystems from \$4.99 to \$4.45 for the Sextant B19 800 by 600 pixels), from \$5.395 to \$4.695 for the 1019 (1.024 by 768), from \$4.395 to \$3.995 for the 815 (800 by 600), and from \$2.295 to \$2.195 for the 516 graphics and 640 by 480).

Software Recording Corp. of America added new graphics features and unlimited run-time capabilities to AutoMentor, its memory-resident software tutorial development program, and also reduced the price from \$995 to \$495. Upgrades are free.

In brief: Automatic reformatting, indentation, and an expanded dictionary have been added to Version 1.16 of AIRUS Corp.'s \$99.95 AI: Typist word processing/spelling checker program. Upgrades are free...Excalibur Sources added a word processor and search capabilities to Version 2.0 of Exsell, its automated salesprospecting system...Campbell Services added a memory-resident option to Reminder, a \$99 daily appointment program. Upgrades are \$25...NewsNet added four monthly newsletters and one software encyclopedia to its collection of on-line high-technology publications. The service is \$15 per month plus \$24 per hour at 300 bits per second; \$48 per hour at 1,200 bits per second. For information, call (800) 345-1301...Daryll Shatz Software released Version 2 of DOS Extensions, an enhancement package at \$55 (\$35 for unregistered but legal copies)...HDG Software raised the price of Legal-Ease, its business agreement and contract program, 45 percent, to \$137.45...Great American Software released One-Write Plus Master, Version 1.02, a \$295 bookkeeping package. Upgrades are \$50...Enertronics Research upgraded its EnerGraphics software package to Version 2.0 after rewriting it in C language, adding eight new fonts, three-dimensional charting capabilities, and pop-up help screens. The charting section is now available as EnerCharts. Ener-Graphics, Version 3.0, is \$605 (\$150 for Version 1.3 owners). EnerCharts is priced at \$405 (\$195 for Version 1.3 owners)...T&W Systems' \$495 EasyCAD, Version 1.03, adds customizable macro capabilities and added line breaking, bending, and trimming... Ashton-Tate and Source Telecomputing Corp. are putting dBASE help on-line in The Source through the aid of ATSIG, a special interest group devoted to Ashton-Tate users.

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> Gita Beant, Fronomics major at UC Irvine



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Joke of the Week

Three IBM staffers out for a drive-a salesman, a hardware engincer, and a software engineer-suffer a flat tire.

The IBM salesman surveys the disabled vehicle and says, "We need a new car.

Counters the hardware engincer: "Let's just swan tires until we figure out which one is

"Why don't we just wait a while?" says the software engineer. "Maybe the problem will fix itself."



Silicon Valley Shopping List: 2 Chickens. Bread. Milk. 3 Floory Disks

Six San Francisco-area supermarkets now offer trial-size samplers-not of shampoo or mouthwash but software. For \$3 to \$6, shoppers can take home demo versions of utility programs such as the Idea Generator or The Little Black Book. If you pop for a working version later, the trial-pack price is Heard anything offbeat about computers-jokes, typos, odd stories, or outrageous claims? Send them to Communiqués, PC Magazine, One Park Avenue,

New York, NY 10016: (212) 503-5293 or MCI Mail 157. 9301 We'll send you a PC Maga-

zine T-shirt and \$50 for each itam urad Contributors to this issue: Steve Aubrey (classified ad), J. Greg Tvl (IBM loke), and Charles Bermant (Silicon Val-

or digitizing tablet. Video op-

tions include IBM CGA and

EGA. and Hereules: AutoCAD

ley shopping list).



and use: 256 layers are available, each of which can be named instead of numbered. A masking system lets you control which entities are visible. Plotter control is quite good. With drawings stored in RAM, speed is good, too, although the single-precision storage-which livens things up-results in less accuracy than is found in double-precision CADs.

Drafix I's dimensioning system is first rate. It permits horizontal, vertical, parallel, radidiameter, angular, centerline, baseline, continuation, and other types of dimen-

sioning.

Text can be entered in any of 12 fonts, with variable height. angle, and instification. But

once text is entered, it can't be modified. However, text editing is planned for the next release The clear, well written docu

mentation includes a technical reference and a tutorial.

The hardware requirements for Drafix I are typical of serious CAD programs. It requires 512K bytes of RAM, but for the largest possible drawings 640K is better (images are stored in RAM, which theoretically limits drawing complexity: the next release will support Lotus/Intel/Microsoft expanded memo-

ry). A math coprocessor is op-

tional. Drafix I requires a

pointing device such as a mouse

has more beyond-EGA-resolution options. The selection of mice, digitizers, plotters, and printers is reasonably broad. Installation is simple and fast. Foresight Resources plans shortly to release a \$95 conver-

sion utility to import and export AutoCAD files All serious CAD users will find that Drafix I offers incredible performance for the price.



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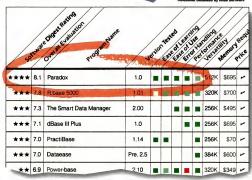


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Software Digest - Rated OVERALL BEST of the 10 desktop organizers tested in its June 1986 issue of the SOFTWARE DIGEST RATINGS NEWSLETTER.

PC Magazine — David Oberegon — "... it's a staggering range of functions ... the Pop-Ups offer more functionality than [Sidekick] ... with less memory penalty."

PC World on compatibility - Model of how RAM resident programs should be "well behaved

infoWorld — "Popular Programs has taken the Sidekick™ idea a Computer Buyer's Guide & Handbook - "the Popular Programs

programs are superior in every way. . . . DeskSet Plus rates the highest of marks."

PC Magazine — D. Barnes & S. Venlt — "Our number one choice among the packages we reviewed is Pop-typ DesiSeft. Or the strength of its integration with DOS and for its speed. We were impressed with the program's ability to let us transfer data from the "Pop-typ DesiSeft Plays modules into our spreadsheet and word processing packages with a single simple command, and its SECTION CONTROL OF THE straight-forward and easy to use and install, to boot." CHOICE

Pop-Up DeskSet Plus

Computer Retailer's Guide — by Mick Taylor of Professional Software Programmers Association

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CIRCLE 370 ON READER SERVICE CARD

SPEED > S Speeds Binary E-Mail

BY BARBARA KRASNOFF

Sending binary and other non-ASCII data over the phone lines can be a real headache. Exchanging data accurately has, until recently, required direct modem-to-modem transmission and was heavily dependent on phone-line quality. The SPEED>S Corp. has introduced an on-line service geared specifically toward improving the accuracy and efficiency of electronic data exchange.

Similar to MCI Mail or CompuServe, SPEED>S users are given an on-line address or box number through which they can send and receive messages. The difference is that SPEED>S is specifically geared to the transmission of programs and non-ASCII files, and error-checks with the Microcom Network

New subscribers purchase the SPFFD>S Flectronic Delivery, Version D, software and manual. The program disk (which already has a unique four-digit address for use by the system) prompts for the information it will need for registration: name, address, local phone access number (SPEED>S uses the UNINET network), and method of payment. You also get a password for the first time you dial into the system. Once you've completed initial registration, the process of ealling and signing onto the service is fully automated

Menu Driven

The SPEED>S on-line service is completely and carefully menu-driven. Rather than asking for the name of the files you want to transmit (a memory game that most communications systems play), it displays a listing of your disk directory. including file sizes and transmission times. SPEED>S also gives you the option of including a 100-character note that will be displayed to the recipient

before he downloads the file. Once you've told it what file to send to whom, the system takes over, pulling in your data

while your screen keeps track of how much of the data is left and how long you still have to wait. A 31K-byte program took 9 minutes to send and another 9 minutes to download at 1,200 bits per second; a 72K-byte program would probably take 21 minutes. Those who are familiar with exchanging data on-line

know that these delays are nor-

Receiving files is equally well implemented. It even includes a polite message that appears after the file has been sent. informing you that if the transmitted program is not satisfactory, you can immediately have your account credited.

Subscribers Only SPEED>S has the same lim-

itation of all the other electronic-mail systems: both the sender and the recipient must be subscribers. But unlike most other such services, it neither asks for an annual fee nor charges for on-line time-once you've bought the software, you pay only for data sent and/or received.

SPEED>S Corp. has added a few enticing extras to its system. As well as sending and receiving files, users can also order from a limited number of commercial programs and templates (once the program is

Formatting Program Code and Beyond: Aldebaran Labs' Source Print

BY VINCENT PUGLIA Occasionally, a utility comes alone that makes a programmer's life much easier. Source Print is such a program. It contributes to the programmer's job by organizing code into a legible format and by helping to organize the documentation and debugging processes.

Source Print supports five popular PC languages-Pascal, Modula-2, dBASE, BASIC, and C-as well as ASCII text. Users input commands at the DOS level by invoking the utility's executable name, the input file, the output file, and any optional switches. Options range from automatic indentation and selective keyword emphasis through cataloging (table-ofcontents creation and line numbering) to manipulation (extraction of specified lines or blocks and imbedded printer control sequences). Also available are options to cross-reference indentifiers, mark nesting levels,

and outline code structures. Where Source Print contributes the most is in its structureoutlining feature. Usually, the programmer has to sit down with the printout and, with the help of a ruler and pencil, find the matching END for each BE- GIN. The tedium and opportunity for error grow exponentially with the complexity of the code. By setting the appropriate switch, you can have Source Print draw lines connecting all of your program's nested blocks, whether each keyword is on a separate line or not.

Smart Merges

Also indispensable is Source Print's ability to selectively extract lines for printing or for mereine into another file. You can designate up to 16 files as the input and set each line range to be extracted from one line to the total file length minus one line. You extract code by line numbers, imbedded identifiers (titles and subtitles), or a combination of the two. You can also generate a table of contents with the imbedded identifiers. Source Print's automatic in-

dentation feature allows you to set the number of spaces for indentation or accept a default of four spaces. If the source code has indentation, the program ignores the original indentation and imposes its own. If line numbers are present in the code. as in BASIC programs, the numbers are right justified and the program code is indented.



Aidebaran's \$97 utility, Source Pratti, offers a structured outline format feature that minimized by the constraint of the place of the property of the place of the place

SPEED>S (continued from perceding page)

downloaded, the manuals are sent on by mail). The SPEED>S package also includes a neat little communications program that is preprogrammed for MCI Mail and CompuServe. Of course, there are many puter data, and large computerized corporations equipped with their own networks will have no reason to subscribe. However, SPEED>S is a well-planned. relatively inexpensive, and truly efficient way for smaller companies or individuals to exchange data with a minimum of fuss and bother.

ways to send and receive com

FACT FILE



430 First Ave. North Minneapolis, MN 55401-1713 (612) 341-0920 List Price: Software: \$50 for a single package; \$60 for a twopackage unit. Price per 1,000 characters (K) delivered: 12 cents per K up to 100K; 7 cents per K over 100K; 3 minimum

per delivery. Volume discounts

Requires: 256K RAM, Hayes or Hayes-compatible modern at 1,200 bps or higher, DOS 2.0 or

In Short: A well-organized and well-presented data-transfer system recommended for individual users or small corporations that need to exchange non-ASCII data on line CIPCLE 605 ON READER SERVICE CARE

Source Print (continued from preceding page)

Because Source Print is primarily a structured formatting utility for source code, it has limitations in the way it handles missing keywords. When Source Print finds nonmatching keywords, it notes this on the command line and marks the output file with exclamation points. If a block has an end but no matching beginning, the line containing the block ending is marked. If the nesting structure is opened but not closed, the marker appears at the end of the text. But in both cases, rather than stopping execution, Source Print continues pairing off all available keywords. Consequently, any pairing after the

This, though, is a minor limitation. To expect the utility to insert the missing keyword would require at least two more passes and could result in even more errors. Between the marker and the outline, you have enough information to locate and correct the error.

missing keyword may be incor-

Source Print's manual effec-

tively documents its capabilities. It also offers a quick-reference card, examples, and a list of reserved words for the supported languages.

No one can argue the importance of having well-documented, legible source code. And Source Print delivers just that-at a savings in both time and money that you can't afford to ignore.



Source Print, Version I.21b Aldebaran Laboratories Inc. 3738 Mt. Diablo Blvd.,#312 Lafayette, CA 94549 (415) 283-7084

List Price: \$97 Requires: 192K RAM, DOS

2.0 or later. In Short: If you program in any of the languages it supports,

productivity and cut down your debugging time. Not copyprotected.

CIRCLE 804 ON READER SERVICE CARD

Learning dBASE III Plus: A Total Approach

BY IRIS KNITTEL

Ladmit it. I'm a creature of habit. I settle down comfortably with something familiar and eye new things with suspicion. So when tried-and-true dBASE II metamorphosed into dBASE III and again into dBASE III Plus, 1 felt betraved by an old and trusted friend. Not only was I being left in the dust, but the dust had

settled For dBASE users like me. TLS Software's A Total Learning System for dBASE III Plus (TLS) can ease the pain of progress or teach the program afresh.

A Walking Tour of dBASE TLS takes you on a general walking tour of the Assistant. dBASE III Plus's pull-down

menu system. The tutorial is organized in six parts: Introduction, Creating a Database, Updating the Database, Creating an Entry Form, Accessing the Database, and Generating Renorts. Each section enlists your participation in working with

specific examples. TLS supplies you with the core of information you must know to use dBASE III Plus. There are a few rough edges, though. First, there's no way to get back to a former screen if you missed something-short of paging through the whole

chapter again. In addition, the tutorial jumps around too much between menu categories, and some of the continuity is lost. My version also had a few Illegal Command notations that occasionally popped up in the lefthand corner. And for those who are used to instant gratification. the disk-generated entries may seem a little sluggish.

TLS will give new or intermediate users a good overview of database management. This, in turn, will enable them to go on and really learn dBASE III Plus by using it with their own applications.



II FACT FILE

A Total Learning System for dBASE III Plus (entry level) TLS Software Inc. 2005 W. Cypress Creek Rd.,

Fort Lauderdale, FL 33309 (305)771-2100 List Price: \$59.95 Regulres: 256K RAM DOS

2.0 or later. In Short: A concise, easy-tofollow way to either learn dBASE III Plus from the ground up or to update your knowledge of earlier dBASE versions.

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TLS uses interactive screens to teach building databases and entering data in dBASE III Plus. Here, the user enters data into a fictional travel agency database.



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Penmouse + : The Mouse Without a Tail

BY GERARD KUNKEL

Give us freedom! PC-based artists have been plugged in and wired up to the computer for long enough. Our mice have their tails in the trap, and our

digitizer pens are chained to the tablet. How are we expected to draw, point, and sketch creatively with something always tugging in the other direction? Well, Kurta Corp. offers an alternative that sets us free.



The Penmouse+, a cordless, penlike device, uses radio waves to communicate with its 81/2- by 11-inch tablet. The tablet is plugged into the computer through an RS-232 serial port and has a very accurate 200-dotper-inch resolution. When tested with Z-Soft Corp.'s PC Paintbrush and Softel's Videograin, the Penmouse+ tracked well, even when drawing with fast circular motions

Since the Penmouse + functions as both a digitizing tablet and a mouse, it can read the pento-tablet position as absolute coordinates (like a digitizing tablet) or as relative coordinates (like a mouse). Switching modes is easy: just depress the pen tip on the appropriate icon on the tablet. The Penmouse+ also includes a utility called Pensmith, which lets it run any program that supports the Microsoft Mouse. In this mode, the pen operated flawlessly with AT&T's Targa Tips image-capture and paint system. The nen has two buttons and

a tip switch. Since the Pen-

mouse + communicates with radio vaves, it has the unique abitity to draw through paper up to 1/2 inch in thickness. This is useful in tracing diagrams or other intricate shapes.

The pen has a few problems. notably the top-heaviness and unwieldy shape caused by the battery that powers it. All in all, though, this is still a small price to pay for freedom.



Kurta Corp.

4610 S. 35th St Phoenix, AZ 85040

(602) 276-5533 List Price: \$295, including SpeedSelect and Telepaint soft-

ware Requires: One serial port. In Short: A cordless mouse alternative that replaces both a mouse and a digitizing tablet.

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- nications line, allowing you to transfer files in any direction. Every PC can be both a workstation and a server.
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Installation and Operation

Thousands of EasyLAN networks have been installed using our Network Install Process. Easy/AN commands such as EZDIR. EZCOPY, and EZTYPE are almost identical to DOS.



I brought access to a laser jet printer for \$80."-CONOCO Oil user.

Specifications

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Life WITHOUT IBM



Will IBM depart from the personal computer marketplace? If it does, which lines will it abandon? And who will be left to set the standards?

magine the personal computer business without IBM—not as if IBM had never participated in it, but as if it had left the marketplace.

Inconceivable? Maybe not.

inconceivable: Maybe not. New York Consider the article in Their New York Consider the article in Their New York Consider the Article was a quoted: White control to the Article was quoted: White ganding the company's shilly to compete with the growing numbers of IBM-compatible personal computer in Mr. Akers said the company would continue to different products and service. But he warred, if you products and service. But he warred, if you products and service. But he warred, if you will produce the company to the comtrol of the company to the company to the coverns the main factor—you will prodbose parts. We are in the business of high margin sales."

Before you start counting the days until IBM discontinues its personal computer line, it's worth reading between the lines. Akers is saying that IBM won't attempt. Akers is saying that IBM won't attempt, to commodify businesses. To the extent that it can make more ye selling PCs with the IBM label, it will continue to compete against one and all. If IBM felt it was really important to keep on making PCs, it would be better equipped than anyone else to do it at a low price.

You can't underestimate IBM's ability to be a low-cost manufacturer. The Proprinter is a perfect example. It's made almost entirely by robots, it's cheap, and it's easily the best product in its price class. Many of the manufacturing techniques pioneered for the Proprinter are applicable to building PCs. And we all have a long list.

of improvements that could be made to the existing PC to increase its attractiveness without running the cost out of sight.

IBM sdistribution channels make a difference, too: they tend to keep the price high. IBM has been adamant about distributing PCs through authorized dealers, but who says this has to be sucrosanet? Mr. Akers's words notwithstanding, there could be some future accommodation between IBM and the discount/direct-sales market. If it turns out to be in IBM's interest to sell a commodity, it will find ways to flood the market with its machine.

DECREASING MARKET SHARE Image leadership is important to IBM. While some sources say that IBM is selling only 35 percent of today's PCs and ATs (down from 70 percent a year ago), that may be enough. It certainly is enough volume to maintain standards. We don't know, however, if it's abo enough to make money.



There is a percentage below which IBM cannot fall: some customers are so committed to the idea of True Blue that they will pay any reasonable price for an IBM personal computer. The reasonable price for an IBM product can be 15 to 20 percent higher than its competition. The number of IBM-committed buyers is somewhere around 20 to 25 percent of the market. These buyers are motivated by compatibility, service, and their National Accounts discounts. Unfortunately for IBM, even as the absolute number of machines it sells rises as the market continues to expand, its percentage of all machines sold drops as PCs find their way into more and more small businesses

Small businesses have never had much of a rapport with IBM. Aside from selling them the occasional typewriter, IBM hasn't had the entry or the cachet with these companies. Small businesses have far more in common with Tandy and the computer stores, most of which are run as small businesses. True, computer stores often recommend IBM-based solutions. but when the chips are down, making the sale is more important to the retailer than selling IBM. IBM's Product Centers were never successful in bringing the IBM message to small businesses because they couldn't carry the breadth of choices at prices that appealed to smaller companies. The Product Centers only confused the lines of distribution in that they made no sense when compared with authorized dealers and didn't fit into the National Accounts scheme. They have now vanished from the scene.

Bostaton Cary None

■ FROM THE EDITOR'S SCREEN

NO OTHER LEADER The prospect of a personal computer market without IBM is unsettling in one respect—standards. For better or worse, the PC, XT, and AT have been de facto standards. The combi-

nation of hardware and software has been the rule book by which everyone plays. But software designers, ever in search of more performance, have written to the BIOS instead of to MS-DOS or even directly to the hardware. In so doing, they undermined one of the higher principles of the operating system—relative machine independence. Compatible manufactures were forced into impossibly small corners in which to innovate or to differentiate their products. If IBM were to leave the market, who would set the standards? Who would docide which hardware Configuration was the "right" one? Whose BIOS would be the "official" version?

Such a move might have the unexpected side benefit of forcing software designers to write to the operating system instead of the hardware. Software performance might drop somewhat, but since overall hardware performance is going up dramatically, we will never actually see the decrease in performance on urdesktops.

crease in performance on our desktops. No compatible manufacturer is the inheritor of 18M's standard-setting role, no matter how match several of them would ment, the only viable standard-bearer is Microsoft. Only Microsoft has the clear to bring (and keep) manufacturers in line so Microsoft on a wide variety of machines. Microsoft will obten continue to work on a wide variety of machines. Microsoft will do its coordination through DOS licenses, not through Windows. Windows. Who was not the work of the will be will be seen anothers, but it will, along this DOS 5.0, help coordinate the designs of 8028s and 8038s bessed machines.

Although the PC AT is PC compatible. IBM regards it as a different product line. The processor, and hence the machine's future, is different. Frankly, there is little danger that IBM will leave the AT market, even though IBM's sales are being seriously croded by everyone from ATAT to PC's Limited. IBM has obviously pinned is office automation hopes on the 80,286 and will go up against anyone who threatens its intended supermacy in this marker will be a supported to the supermacy in this marker.

Will IBM stop making personal computers? No way. Will it stop making 808abased machines? Very likely. With hardware and software development for the 8088 all but stopped, it doesn't really matter. The future is in multitasking operating systems and connectivity.

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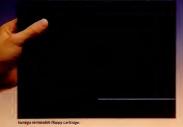
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IBM STEALS NCC BY DEFAULT



As the only big American company at the moribund NCC in Las Vegas this spring, IBM was all over the place, spouting about "connectivity" and giving embarrassing rap-style demos.

TCC 1986. What do you write about when there's nothing to write about? Senior editor Bill Howard kept saying that he's never before gone to a wake where you had to wear a plastic badge. Estimated attendance was 20,000 or so. This is a far cry from the throngs that previously poured into this once-popular elder statesman of computer shows. To make matters worse, IBM somehow

co-opted the show

Except for a few names like Honeywell, IBM was the only big American company to show at the National Computer Conference (NCC).

IBM had the best booth. And all its sales rens were booked to microphones that transmitted to little speakers over the individual displays. It was a neat idea. When one of these showmen was talking to some guy, we could all listen in. The idea was to save people from having to answer the same questions over and over

Golly, this is nifty. I thought to myself. I hadn't gone to NCC for the past 2 years for one reason or another and wondered when IBM first used this sound system. I asked around, but nobody knew. Finally one fellow took me to another fellow who supposedly designed the system.

'You'll have to talk to a press person about the system." he said.

"Huh? I only want to know if you used it last year."

"When did you first start using it? That's all I want to know. I haven't got time to talk to a press person for such a simple question," I said.

"Uh. We've used it for 3 years. But if you want to know how it works, you have to talk to a press person."

This reply infuriated me. I was only asking because I thought it was a nifty system and that IBM should get some accolades. But this guy wasn't proud of it; he was worried about losing his job if he talked to the press. He was defensive and obnoxious. "How it works!" I said. "It's a microphone hooked to a speaker!"

I had to wonder what kind of sheepish personnel they're training at IBM who haven't got the guts to make the simplest comments about the most mundane things without permission from Mom.

In the meantime, because DEC, Hewlett-Packard, Data General, and the other name-brand manufacturers had dropped out of NCC, IBM ran roughshod over the show. NCC and IBM were synonymous this year. It almost seemed planned-a setup. IBM used its platform to make a jillion boring announcements. At every turn, it promoted its new buzzword: "connectivity." The press ate it up.

RAPPIN' BIG BLUE IBM even tried some comball demonstrations, the worst

of which was a "rap" demonstration that was embarrassing to watch. Using a black female employee, IBM attempted to be funny or cute. I guess. The woman was on a little stage with a

couple of printers. She would talk in rap, then explain herself like this: This isn't the kind of pitch you'd expect

to hear from IBM. After all, you can't break-dance in wing tip shoes. But despite our image. IBM is hip to your needs for systems that work together to help you communicate. I'm Dot Hutchins, a systems envineering manager from IBM in Boston, and I'm rapping with you today because rap music, believe it or not, has a lot in common with IBM. Take our printers, for instance-like rappin', they're fast, they're happinin', and they both have some pretty outrageous ways of expressing themselves. I'm talkin' dots and colors. I'm talkin' bar codes and data and word processing capabilities. I'm talkin' total printer connectivity.

I'm talkin' who are they kidding?

LAST NOTES ON NCC As for the rest of the show, the Smothers Brothers, Paul Revere and the Raiders, the Righteous Brothers, Juice Newton, and Ray Stevens were playing the Las Vegas strip during NCC. This led one cynic to call the whole scene "The Big Chill meets NCC." When will these old-timers retire?

The smartest exhibit at NCC was the little Alka-Seltzer booth between halls where they were giving away samples-much appreciated, I'm sure, by the hapless ex-

The biggest attraction in the 108-degree Las Vegas heat was the new Wet and Wild water-slide park. It was dubbed "America's Wettest Park." I thought it appropriate that it would be in the same town as America's wettest show. (Groan!) Or is it that the show was slipping? No, it was sliding! Stop me if I'm going too far.

My final recommendation for NCC: move the show to Reno.

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INSIDE TRACK

Microsoft buys a competitor-ploy or positioning? And a super new telecommunications program.

ast month, one of the most significant events in the history of microcomputing took place. Microsoft announced the purchase of Dynamical Systems

Dynamical is the company that developed Mondrian, a TopView clone that supposedly runs rings around TopView and takes up two-thirds less memory. I saw it some time ago and it was hot, even though TopView was not. Professors and wizards coded the thing. With zero marketing experience or expertise, Dynamical figured that it would market it to OEMs (original equipment manufacturers). It figured wrong. TopView itself never took off, and Dynamical's OEM strategy failed. The product should have been marketed directly to end users right from the beginning.

Be that as it may, the product represented a threat to both TopView and Windows. Supposedly, Dynamical had tried to sell Mondrian to IBM, but I was told that "they were talking to the wrong guys." Maybe not.

It's entirely possible that IBM would rather do business with a company like Microsoft than with a bunch of guys working in an Oakland attic (where the coders slaved away). On the other hand, it may just be that there's more to this deal than meets the eve.

Here's the scenario: Microsoft bought out Dynamical for a song, "Nobody got rich on this deal," I was told by one source. "They got a lot less than you can imagine," said another. Nobody knows exactly what Microsoft paid for the company, but it seems to be something like \$200,000 and some stock options. Microsoft also gave eight programmers lifetime jobs (how noble of it). Meanwhile, unstated in the press release

and unknown to Dynamical is the real possibility that IBM will end up with the code and that Microsoft will clean up in royalties.

Here's where this sale fits into the overall scheme of things. A slew of microcomputer manufacturers are trying to standardize an 80386 machine to do an end run on IBM. Phoenix Software is leading this group with support from companies like Compaq, which should have supported (or bought) Dynamical when it had the chance. IBM doesn't want to see an early use of the 80386, however, because it will impinge on its profitable System 36/System 38 business. Instead. IBM wants to milk the 80286 for all it's worth for as long as possible. At the same time, IBM wants to cut off some of the clone makers from taking too big a slice of the IBM pic. And, finally, IBM surely doesn't want to see the marketplace confused by an 80386 machine designed and standardized by a

So, IBM plans to release PC-DOS 5.0 earlier than expected. Version 5.0 is said to be hotter than hot. It will feature true multitasking. IBM hopes to make the 286 so attractive that there'll be no early interest in 386-based computers. It would very much like this move to breathe years of life into the PC AT gencration

PC-DOS 5.0 will be called something new, incidentally. It will be dubbed Super-DOS or Taskmaster or who knows

According to gossipmongers, there will not be an OEM version of DOS 5.0. and somehow TopView will be part of the system—maybe in ROM. As it now stands, the IBM version of TopView is simply too massive to put into ROM

cheaply. So here comes Microsoft with its version of TopView which is decked out and ready to ROM. The end user will never know the difference. Let's call it TopView 3.0 or some such nonsense. Meanwhile, let's guess which 80386 machines will be out of luck in the compatibility agme.

Even if IBM doesn't want Mondrian, Microsoft can put it into a Windows interface and sell it to Compaq, Hewlett-Packard, Wang, and some of the other also-rans

Then again, perhaps Microsoft can make itself a sweet deal with Godfather Big Blue to quietly remove Mondrian from the market, leaving no TopView clones for anyone. Get the picture?

In addition to all these machinations, I'm told that IBM has truckloads of TopView-specific software ready to roll when it announces the new operating system and new ROMs. This all should take place before the end of the year. We'll see.

Meanwhile, I don't like the looks of any of it.

Gentinely Interesting Software Department. The hotest software packed in the country right now is a shareware or socalled user-supported telecommunications software package called Procomm. It was written by a couple of guys named was written by a couple of guys named with and Barkelew who sequestered themselves in the Missouri woods so they could dedicate their lives to this thing. It costs a votmatry \$25! Most user groups have a point of the process of the couple of the couple of unitary \$25! Most user groups have a computer and salesman.

Written in C, it is a fabulous telecommunications package that has fancy windows, PC-Talk-compatible operation, and does file transfers in Xmodem, Kermit, Telink, Modem?, YModem XModem back, and ASCII capture. It's bot stuff. It has a superb feel. From PIL. Software, Box 1471, Columbia, MO 65205. Call on the company's BBS at at 3(3)44.494.901.

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CARVING A NICHE IN THE SOFTWARE INDUSTRY



Many PC software companies that made it onto the Soft*letter 100 list came from "kitchen-table" roots; here's how you can make it, too.

In the last issue, we revisited a group of software enterpreneurs that I first introduced in these pages 2 years ago. I gave them colorful pseudonyms, but they were all real enough; each was a PC software pioneer with whom I was personally acquainted. In this column, I di like to look at where such "kitchen-table" entrepreneurs fit into the larger context of PC software and the lessons would-be entrepreneurs can learn from them.

SURVENING THE SOFTWARE SCENE
An increasing Humans and respected survey known as the Soft*letter 100 (167, 674
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62138; (617) 868-0157; 5135 per year for
56 issue); can teach us many lessons about
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of the industry, is among those I value
most highly.

For 3 years running, Sql*-thern bas compiled a survey ranking the 100 biggest independent micro software companies, from Lotts on down. It excludes 1BM (not "independent") and Mr. Dutch Treat of software maker), but it does cover most of the PC software industry as we know it. And, surprisingly, many of the group I've been talking about made the list. I think, in cite, that more of my group belongs on the Sdl*-tern 100 list than actually appear never be ranked among your peers).

What's amazing is that three of the entrepreneurs I discussed in the last column actually made it to the top half of the list. (One of them made it into the top ten, and so now hardly qualifies as a struggling little entrepreneur.) So much for kitchen-table software being small potatoes.

While the upper reaches of the Soft® letter 100 belong to big, serious companies such as Lotus, Microsoft, and Ashton-Tate (the Big Three), about 80 of the most successful PC software companies really do spring from kitchen-table roots—a very encouraging fact for beginning entrepre-

MAKING IT INTO THE TOP 100 You're probably wondering what it takes to make it into the top 100. To be number one (Lotus), you have to rake in nearly a quarter of a billion dollars a year. Egad! But to make it onto the list both this year and last, sales of \$1 million were suffi-



cient. In one sense that's disappointing because we'd like to think that there are many hundreds of PC software companies knocking down a million a year and that the top 100 would be making much more. Still, it's fascinating to think that the majority of the folks on this list come from the ranks of hungry and ambitious PC Magarian readers.

The list reveals some very interesting things. The most important lesson to be learned is that most of the companies found their success as niche players who discovered a small but attractive specialty area, of which they could own or control a large share.

Consider Subbogic, the master of PC simulations that created the Microsoft Flight Simulation and the suspertix new JF flight Simulation and the suspertix new JF simulation programs. Subbogic grossed 54 million and did very nicely on the Soft¹-ter 100, making number 42 on the list. Or consider Funk Software, maker of the consider Funk Software, maker of the Microsoft Software of the Software of the Software of the Software of the Software Software of the Software Software Software Software Software Venture was lucky enough to make number 4.

TWO ROADS TO SUCCESS These companies illustrate two distinct roads to finding a successful niche. The first is to find some independent software area small enoughs on that nobody by the agotten there yet. Sublogic's realistic simulation games—the pinaball game Night Mission and the flight simulations, including let—fit into this category, as does my Norton

■ PETER NORTON

Utilities. With this strategy, you look for a function that's just not important enough to attract more-powerful competitors.

The second road to potential success is

the add-on route—creating software that

piggybacks on the success of some other hit software. Fox & Geller has been having fun and making good money enhancing, extending, and explaining Ashton-Tate's dBASE systems. Funk's Sideways pro-

gram piggybacks on Lotus's 1-2-3. (Actually, Sideways performs a general-purpose print operation that could be thought of as belonging to the previous category, but, in fact, it really makes its sales as an add-on for Lotus users.)

AVOID COMPETENG WITH THE BIG GUYS The message for aspiring software entrepreneurs is to avoid competing with the big guys and don't try to make your fortune with amother spreadsheet, datafortune with amother spreadsheet, datator that the state of the state of the that isn't an infallible rule, though, consider that several of the Soft*Plette 100 have achieved their success in just that way. Lifetree with its Volkswire and XyQuest



with its XyWrite, both word processors; and ButtonWare with database and word processing programs.

That just goes to show that it is possible to do very nicely by getting a small stice of a big pie, by being a minor player in a big applications game, like word processing but in my judgment that 's a precurious position to be in. It's better—from the point of view of a small start-up software company, particularly a one- or two-person operation—to be the big fish in a small pond than a small fish in a big pond. Small fish are too easily eaten by bigger fish.

Generally, being the first and biggest in a software niche pays off in long-term success; it's darned hard to unseat a recognized leader and champion. That's why Paul Funk, the king of sideways printing, and I are relatively safe in our successes, particularly if we don't get lazy and complacent.

RISKY BUSINESS Nothing in life is safe, of course, and even being a niche player has serious risks. Paul has his share of competitors trying to dethrone him, and



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The semple screen display shown below is typical of what you see while editing a chart. Other screen displays are provided for entering titles, changing ions, getting "help" and so on,

■ PETER NORTON

more folks have gone gunning for my title as king of file recovery than I've been able to keep track of

And just to show you that it doesn't always work out that one person forever remains on top of the heap, look at the case of keyboard macros. Somebody, I've lost track of who, was dominant in that game until Dave Roses's ProKey became the macro program that everybody uses. More recently, the baton seems to have passed to Borland's SuperKey. VisiCalc owned the spreadsheet market until 1-2-3 took it away. WordStar was the word processor once, but no more

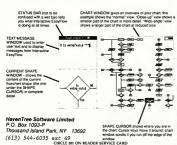
But even if the former leader of a software genre gets knocked out of the domi-

 Successful software. develops a tremendous inertia that keeps it going even after its time has seemingly passed.

nant position, in many cases it remains in a comparatively comfy place. Consider that VisiCalc hung in there long after 1-2-3 "killed" it. Consider that MicroPro's WordStar is still selling well (just not dominantly) and that MicroPro is number 5 on the Soft*letter 100 (though their revenues shrank by \$15 million from the year before). And consider that even though the CP/M operating system is said to have been dead for over 3 years, it's still bringing in enough money to make Digital Research number 4 on the Soft*letter 100. And that is the key reason why my message to budding software entrepreneurs is that the best way to attain success is to find

Successful software develops a tremendous inertia that keeps it going even after its time has seemingly passed. In the volatile, live-or-die software world, that's a comforting thought-and all the more reason for us to direct our hopes for success toward niches where we too might become number one.

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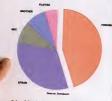
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FCC CERTIFICATION WARS, PART 1



Our PCs are a part, if a minor one, of the RF/EMI-emissions problem. Seymour takes a look at this latest source of "noise pollution."

PCC staffers marched through the exhibit halls at the Atlanta Comdex a couple of months ago in a style some found reminiscent of another march across Georgia more than a century ago.

Raiber than burning down-everything in their path, à la General Sheman, he FCC staffers made a lot of exhibitors feel burned up when their items were tagged for failure to comply with FCC RFEMI Class B emissions standards. When the FCC people had finished—and had tagged more than 2,500 tiens for noncompliance, meaning they couldn't be sold and could only be shown with a "not yet approved" only be shown with a "not yet approved" and the standard of the standard in the mouths of quite a bot of PC-industry people.

I watched the process with some amusement. On the one hand, if the law says equipment should meet reasonable standards, manufacturers shouldn't evade those regulations. On the other, my antipathy toward unnecessary and often simply goofly governmental regulations runs deep.

So I began digging into the nature of computer-generated electronic "mose." how and why it's generated and what there is that vendors can do to reduce emissions levels, what you and I do subsequently that reinforces or undercust shose efforts, and finally the broader social issue of the seriousness of the effects of all that radio-frequency (RF) energy bouncing around Out Three.

My tutor through part of this trip was Dave Staggs, one of the handful of recognized experts in dealing with spurious emissions. For a decade Dave was the top gun in emissions reduction for one of the major office-automation-equipment companies, and now he's a vice president in an engineering firm working on measuring and assessing RF/EMI problems. Dave works with quite a number of PC companies on tugging their products into conformity with the FCC's standards, and I'm indebted to him for all I learned in our trips to the workbed.

TWO STANDARDS First, about those mysterious FCC Class A and Class B standards. The Class A, or office-equipment, standard is the looser one; Class B, or residential-location equipment, is held to a tighter test.

Why? Because the FCC rightly figures that most of the TV sets, radios, and other electronic receivers with which our machines' emissions can theoretically wreak havoc are found in homes, and if we're go-



ing to haul a de facto noise generator into that setting, it should affect our neighbors as little as possible. Fair enough.

As sophisticated electronic devices, our PCs are potentially rich sources of interference. Prime sources of stray energy inside the PC are the clock circuits that time microprocessor operations (whose harmonics are deadly), the high rates of data transmission among components, especially from hard-disk controller cards to the hard disk itself, and the ever-faster designs being used for logic devices.

Beyond those sources lie the connectors, such as serial ports on the back plane of your PC, which are veritable founts of RF energy, and finally the system cables (engineers like to call them paths), which can wind up broadcasting that energy like antennae.

But do PC-scale noise emissions really count? Is all this a Tempest (forgive the pun) in a teapot?

Staggs says that many stories about serious problems resulting from PCs interfering with other systems are probably apoccyphal. but that he's seen field notes from joint PCC/FAA investigations that confirmed temporary interruption of sensitive aircraft instrumentation, such as Instrument Landing Systems (ILS), in planes on final approach when flying over homes with very noisy PCs.

Moreover, stick three or four PCs into a shared office—say, a typical office "bullpen" about 12 by 15 feet or so—and you can generate sufficiently intense RF-noise fields to begin getting occasional garbage on-screen and in printouts.

■ JIM SEYMOUR

INCREASING RF NOISE The real problem, of course, which the FCC's sudden turn toward strict enforcement of PC regulations only partly solves, is the steadily increasing wail of background RF noise with which we live. That noise comes from everything from blenders, food processors, and can openers to CB radios, dimmer switches, and PCs. While the noise level is still far below what little we know about human-safety thresholds. it's increasingly a threat to critical communications links, to say nothing of your daughter's TV set or your neighbor's videocassette recorder.

A U.S. Environmental Protection Agency study in the late seventies measured background, or ambient, RF levels at 72 sites in Atlanta, Boston, Philadelphia, and Miami. RF field-strength measurements ranged from 2 to 3 volts per meter, with 95 percent of the sites reporting readings greater than 2 volts per meter.

 Stick three or four PCs. into a shared office and you can generate sufficiently intense RF-noise

fields to begin getting occasional garbage onscreen and in printouts.

A Canadian study of various metropolitan areas found readings that had moved up from about 1 volt per meter in the early seventies to 3 volts per meter in the early eighties. The figures are certainly higher today.

A SUBTLE EFFECT The higher noise levels are having a noticeable effect, if only in small and subtle ways. For example, users of VCRs made in Korea, where RF/EMI controls are relatively loose, are finding those recorders susceptible to problems with all that ambient RF noise. while users of VCRs from Japan, where RF/EMI controls are tighter, are having little trouble.

That whole issue of susceptibility to RF/EMI noise is really the other side of the coin in emissions controls. Next time we'll look at what the FCC is or isn't doing about it, as well as some war stories about PC vendors' attempts to quiet their machines-and how we sometimes defeat their best efforts

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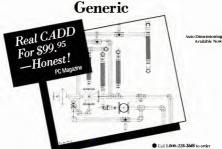
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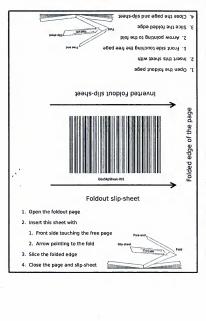
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teep your winters running at the common terms of the common terms of the life common terms of the common terms of the different printer, a laser-jet and a picter, you do your normal print routine but insert a short printer select code (which you can define yourself) asthe first characters of your data. The data is then routed to the selected printer. It's

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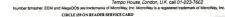
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PREDICTION: A GROWTH INDUSTRY



Although the number of computer clairvoyants has been growing wildly, technology marches along at a pace that few can predict.

hat's the fastest-growing segment of the computer industry? The prediction business. Every time you open a magazine, you run into some 'industry expert' out on a shaky limb with a guess about the latest burning issue: sales growth, market share, new technologies, next week's Lotto number.

Sportswriters who guess the pennantrace winners during spring training are publicly chastised in October. Since there's no official end to the computer season, nobody ever goes back and checks up on the pundits—lucky for them.

COMPUTER CLAIRVOYANTS A Couple years back, the most reckless computer clairvoyants were momentarily jolted into caution by the failure of their wild scenarios projecting exponential growth in the computer business for years to come. You remember: a computer in every home in the land, an electronic linkup to banks and stores and news media. In fact, the home computer boom unmed out to be little more than a way of selling videogame machiness while assuaging parents' guital about them.

The much-hyped virtues of videotes have managed to liure all sorts of big players, from AT&T to Time Inc. to a weind IBM-Sears-SE triumvirate. Returns? Zilch everywhere but France, where the state-owned phone company gives every-body a terminal instead of a phone book. Here, where paper phone books compete with one another, every single test of videotes has turned into a money sing.

Voice recognition and synthesis? Read some old predictions, and you'll wonder why you're not dictating your memos directly to your machine. Natural-language interfaces? "It don't understand the words in your query." Did the world flock to PCjr? Did the Macintosh usher in a new era of "user-friendly" computing? Did the world give the Amiga a hearty handclasp?

ON THE BANDWAGON Prognosticators jump on bandwagons because the tors jump on bandwagons because to don't want to be left in the slums listening of to some derelic's boom box. Anybody out there own a video carridge player, the wonder product of the early sevenies? No, no a VCR: I mean the early "read-only" carridge machine that companies and carridge machine that companies and search work of the companies of the same of the companies of the companies of the hardward and softward and a surprise conomic recession dealt the whole idea a deathblow.

Many of the rodents who deserted that sinking ship jumped aboard SS Video Disk—a catamaran with two leaky, in-



compatible hulls. RCA's format, a technological stiff, lost the company plenty. The vastly superior laserdisk, still limps along, but mostly in special high-end situations. Like the video carridge, the laserdisk had everything going for it except cheap hardware and software and the absolutely essential ability to let the user record. VCRs stomped all over

Yeah. Maybe. Not long ago, on the crest of the great video game wave, much hype was centered on the joys of "interactivity." Interactive fiction would give the act of reading a new push. People would get involved in lifelike simulations of everything from atomic warfare to fishmongering.

What happened? For one thing, interscring with a computer often seems, cating with a computer often seems, cating with a computer often seems, cating with content interactive software war work hard work that few could do well. "Interscrive ficion" never got much beyond savive ficion" never got much beyond to the top to the catenate of the catenate of the top to the next level of the catenate of the saving war work of the catenate of the catenate of the and the fast that topped interactive computer games from their brief reign was an unterly assive catrivity watching MTV.

■ STEPHEN MANES

ANIMATED DUODENUM The CD-ROM has standardization problems that need to be overcome, but software worries may be even more critical. Sure, having The Oxford English Dictionary and a gen-

uinely complete thesaurus on-line at the press of a key will be a godsend to folks who need to refer to them in their work. But will your kid really become a better scholar by using an electronic Britannica to call up an animated diagram of the duodenum?

Besides, you're probably not going to see that realistic peristalite action in any hurry. What's more likely is a wave of recycled classics and public-domain stuff on CD-ROM. The Complete A.A. Milne. It's a lot ses risky than commissioning a farey new project with expensive artwork for an uncertain marker.

Maybe you'll be able to slip the complete oeuvre of Louis L'Amour into your shirt pocket instead of your pants pocket. But how much of a break are you going to get over the price of the paperbacks? Will Louis stand for any reduction in his royalties? And do you want to read his works on a computer screen anybow?

A CD-ROM can suck up quite a lot of information, and deep-pocketed corporation customers word in mind paying high prices for it. The rest of us, however, are likely to wait for a future version of CDs on which we will be able to store our own copious quantities of data—ap product that will be as different from the CD-ROM as the VCR is from the videodisk.

DEAD WRONG. And undoubtedly I'm dead wrong about a lot of his. That's the trouble with prognostication: trees obscure coests. Who in the infancy of the micro-computer could have perceived that the little giants would create even a enth of the business they have? How many of the apostles of office automation could have foreseen the inexorable demise of dedicated word moresosm?

Technology marches forward but only rarely at the pace we export. Movies with sound were demonstrated 30 years before they became routine: Television took decades to become ubiquitous. The microwave oren needed enerly a quatter-century to penetrate half of America's bouseholds. 4th this moment, somebody is probably creating something that will not become a bousehold word until the year 2012. Next cool rationality they reserved for the Colecto Adam.

Only two predictions are as sure as death and taxes: IBM will still be around in some form in the year 2000; predictions will be, too.



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I BOUGHT MAIL ORDER!



So you want the best equipment, the best price, the best service? Here are some pros and cons of buying by mail for experienced users and novices.

can't take the guilt anymore! I admit it: I bought a computer from a mail-order company. I've decided to come out of the closet, and this is my signed and witnessed confession.

I. Stewart Alsop, did in the month of April in the year of the Lord inincteen humdred and eighty-six purchase the following products through the mail from 47th St. Photo, a firm in New York City: a Compaq Deskpro 286, a NEC Multisyne monitor, a Hayes 2400B modem, and a Hewlett-Packard Laseriet Plus printer.

CONDEMNED BY THE INDUSTRY Whew! Now that that's out we can have a sensible discussion about why mail order is so roundly condemned in the personal computer industry. The industry seems to believe that mail order is a despicable way to foist computer products on an unsuspecting public.

That's why I'm confessing. I'm a critic and analyst of the personal computer industry and am therefore expected to have honorable computer-use practices. And, in fact, I don't give away (except to schools) or sell copies of my software. Nor do I invest in or consult for the companies I write about (despite my lust for the money that would bring).

GOOD FOR ME? But when it comes to buying computer products, I'm sometimes mystified by what the industry believes is good for me. I want to buy specific brands, and I want them at the lowest price. I don't need to suffer through the salesperson's attempt to understand what I do. And I've learned from painful experience that the only way to get what I want out of a computer is to keep trying. I've never had any luck getting somebody at the other end of a customer-support number to reveal the intricate secrets of how to do whatever I wanted to do; friends and acquaintances who have faced a similar problem provide the best support. And I want to buy from a retiable, well-manaeed commany.

Take my recent experience: For the last year, I've been buying stuff from a local Microage store (in San Matso, California), a small enterprise run by a fellow manned David Chang. This store has been very good to me. Change fixes everything himself, and when the hard disk on my computer died last January, he spens several evenings and a Sunday moming getting assensed presented to work. The series of replacements to work. The disk was out of warranty, and I paid for as much of the work as Chang would allow.

When I wanted to buy a PC system, I



asked that store to bid on it. I also priced the same components in 470 is. Photo's catalog. Microage's bid was about 15 percent higher, so thought from 47th St. Photo. (There are other good mail-order bouses, such as Compo Lapoine in Portland, Oregon, and PC Connection in Marlow, New Hampshire, but 1've bought stuff from 47th St. Photo before and like its service.)

When the hard disk dish! work, 47b.

S. Proto swapped system units with me by overnight delivery and paid the freight harge (which is substantial on a 54-pound born, 161 had bought the system from Mirroge, 1 probably wouldn't have had to install the modern, display salpster, and memory cards myself. And I probably wouldn't have spent a week discovering that the DIP switch inside the lesser printer was set for serial communications when I was using a parallel connector.

HOW PEOPLE BUY Therein lies the truth about how people buy computer stuff. Which buyers believe that it's worth an extra \$1,000 to be sure that a particular system is fully configured before they take delivery? New buyers and those who don't want to be bothered will pay the higher price. Those who know what they want and bow to make it work won't.

The problem is that the industry not only wants everybody to buy the same way but has tumed the issue into a moral battle between right and wrong. Since the industry got started about 6 or 7 years ago, PC companies have distributed their products primarily through retail dealers. (Before

■ STEWART ALSOP

that time, everything was sold through the mail.) The companies, believing that they were starting a revolution in the way people work, wanted to make sure that the revolution progressed with a minimum of

frustration. Since few people knew how to use their computers, the companies felt that the only way to make sure buyers weren't frustrated was to hold their hands along the way.

REVIEWS IN BRIEF

ADVERTISEMEN

Turbo-Cool: Keeping Your PC from Overboiling

BY JIM FORNEY

After years of slaving over hot circuitry, my faithful, overloaded IBM PC is running at least 15 degrees cooler these days thanks to an add-on cooling fan called Turbo-Cool from PC Cooling Systems. Turbo-Cool (formerly known as "Silencer, model HP") bolts onto the back of the PC over the power supply's exhaust grill, drawing up to 100 percent

more air through the unit. Prior to installing the Turbo-Cool, I measured a 30-degree temperature rise above ambient room temperature with a temperature probe positioned just above the motherboard and tucked in between two expansion boards. With Turbo-Cool installed and the temp erature probe in the same location, the temperature rise was cut exactly in -a mere 15 degrees hotter than my room-and the top of the PC's cabinet was significantly cooler to the touch at the hottest point (just above the location of the probe). Although "Silencer"-the name under which it was originally marketed-was a misnomer, Turbo-Cool's fan is much quieter than IBM's built-in cooling fan. In fact, there is no significant increase in the noise level with Turbo-Cool running.

Installation couldn't be easier, as it does not require going inside your computer at all. To install Turbo-Cool on a PC or XT, all you have to do is remove four screws from the back panel that secure the power supply in place. The power supply in place with the power supplied with the screw that screws the supplied with the back into the same holes. The Turbo-Cool unit is just 3 inches thick and adds that much to the depth of a PC

when installed, but in terms of required clearance behind the CPU, it doesn't add much beyond what you would normally leave to prevent kinking all those connecting cables anyway.

The fan is supplied with a "Y" power cable, one end of which plugs into the monitor outlet on the back of the computer so that Turbo-Cool turns on automatically when you start your system. The other end of the Y has a monitor receptacle similar to the one that the fan has taken, so none of the

original functionality is lost. Two overheated my computer more than once, especially in hot weather theat can be a major problem and can cause all manner of strange things to happen, as well as shortening the lifespan of all those expensive plug-im boards in the strange than the second plug-im boards in the second plug-important plug-i



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The text is reprinted (unedited and unabridged) from PC Magazine March 25, 1986. Copyright © 1986 Ziff-Davis Publishing Co. But a funny thing happened: people who bought computers learned to use them. So when they went to buy another computer, they shopped for price over service. But most hardware and a few software companies have been slow to understand the phenomenon of the experienced buyer: they're still treating experienced users like greenhours, even though such so-phisticates now account for the majority of sales.

SELLING AGGRESSIVELY Software companies, pressed by much stiffer competition, are loosening up. Spurred on by Borland International, smaller companies have begun to soil agressively through the mail and through mail-order dealers. Big-ger companies are beginning to realize that there are different ways to sell software, but they have been slow to use any but the biggest mail-order dealers, such as 800 Software.

But hardware companies seem to think that every buyer is a novice needing help with their products, and the firms have adopted a benovlent-dictator stance by restricting product distribution to stores. The problem is that by assuming dealers will alway problem in the passuming dealers will alway hardware vendors have not paid sufficient attention to whether the customer actually gets serviced.

As far as the vendors of the products that I bought from 47th St. Photo are concerned, I've got leprosy. With the exception of Haves, none of the companies whose products I bought maintain a customer-support operation for users. What's most amazing is that all of the products have abysmal documentation. Compaq's manual, for instance, assumes that I bought their monochrome monitor to use with their supplied video adapter: it fails to explain the difference between monochrome text, color graphics, and enhanced color graphics. The manual for the HP Laserjet buries the reference for a DIP switch that must be reset for serial or parallel communications in Appendix C.

A USER'S PLEA So what I'd like to know is why these companies think that I can't decide how I want to buy my equipment and why I'm not important enough to get the right information.





























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he PCAT is a real spoiler. If you use an AT at work and a PC or XT at home, you know how bough it is going back to your old machine. You've probably grown accustomed to the difference in the key-boards, but you'll never get used to the difference in speed. Starting with the boot-up and for every

minute of use, your PC or XT reminds you how hopelessly outclassed it has become. You almost expect cobwebs to grow across your screen as you wait for the machine to do things that take no time at all on an AT.

Speed is not every-

thing—it's the only thing. It is the most important characteristic of a computer's hardware and the only reason to use a personal computer in the first place. Recent trends in hardware and software point up the processing deficiencies of the PC and XT more than ever. As expanded memory boards let spreadsheets break the 640K-byte lim-

it, recalculations seem to take forever. The Enhanced Graphies Adapter has more pixels and more colors and thus requires appropriately faster processing. A sophisticated multi-tasking system, such as Microsoft Windows, running on a stan-



dard PC-XT with an EGA is almost intol-

R's not pleasant to realize that a machine you spent good money on has become obsolete. The body's ingood shape, but the thing really needs a brain transplant—which is to say, it needs an accelerator, or "turbo," board. Such a board replaces the slow microprocessor and associated circuitry in your machine with somethine faise.

solutioning attention of the beautiful production of the beautiful products for the PCA T (see sideby "Speed Up Your AT"), but this story is really for the rest of us—those who may eventually get an AT. but who, in the beautiful products for the the beautiful production of the beau

INTEL'S FAMILY Inside your PC or XT, roward the back of the system board midway between the power supply and the rightmost expansion olds, sits an Intel 8088 microprocessor. The 8088 does the bulk of the processing workload in your machine. Flight years ago, the 8088 was a real hot-back. Now, compared with Intel's entire line of 16- and 32-bit microprocessors does including the 8088, 80188, 80188, 80188, 60184, 80184,

Although this 8088 microprocessor is in a socket on your PC or XT system board, you can't just yank it out and put a faster sibling in its place. None of the other Intel microprocessors is "pin-compatible" with the 8088. The pins that go into the socket do different things. The 80186, 80188, and 80286 processors, in fact, are not even the same size and shape.

The only available microprocessor that is pin-compatible with the 8088 is the V20 from Nippon Electric Corp. The NEC V20 is probably the cheapest way to accelerate the processing speed of PCs and XTs (see "Turbocharging Your PC with the V-Series." PC Maeazine. Volume 4 Number

26). The trouble is, replacing your 8088 with a NEC V20 improves overall processor speed only by about 5 to 10 percent,

which in actual use is hardly noticeable. The main job of a microprocessor, like the 8088, is to read machine code instructions from memory and execute them. Some of these insurancias may also access to the second of time that is often densed by a major of time that is often densed by a major of time that is often densed by a major of time that is often densed by a dense of time that is often densed by all you have to know is that the fewer clock cycles required to execute the machine fragility of the second of the

■ The 8088 is still

rolling out of bed in the morning while everyone else has already eaten breakfast and gone out the door.

machine-code instructions and the number of clock cycles required to execute them for the various Intel and NEC microprocessor. The 80286 is the microprocessor used in the PC AT. The 80386 clock cycles are somewhat deceptive because of an advanced pipelining technique that that chip uses. Actual execution in the 80386 clock will be faster than the clock cycles indicate.

The tuble begins with some simple instructions that have not been improved very much in the later models. The donothing NOP (no operation), for instance, continues to take three clock cycles regardless of the microprocessor. The more complex instructions like integer multiply (MUL) and integer divide (IDIV) show impressive improvement with the more recent microprocessors. The earlier processors executed these instructions using a "inacroacide" iconinger, where the instprogram. The NEC and later Intel processors incorporate dedicated hardware for these complex instructions. (In actual programs, these instructions are relatively rare, however.)

The clock cycle times represent just the internal execution time of the instruction. If the instruction also has to read or write data in memory, more clock cycles are required. All the Intel and NEC microprocessors shown in Figure 1 (except for the 80286 and 80386) require four clock cycles to read or write a byte in memory. The 80286 and 80386 can do it in two. The microprocessor must also read the instruction from memory before it executes it. This is called an instruction fetch. The overhead involved in fetching instructions is minimized in Intel's 16-bit microprocessors by using an instruction queue that reads in instructions while the processor is doing something else.

Although I said earlier that you can't simply take your 8088 out and put another lintel microprocessor in, many accelerator boards contain the hardware necessary to translate the signals of a faster microprocessor into the signals that your system board expects from the 8088. In effect, the turbo board says, "Step aside, slowpoke! One of your faster siblings is taking over this machine."

CLOCKING THE CPU When I speak of a clock cycle, the "clock" in question is the crystal oscillator that paces the work of the microprocessor. The crystal oscillator generates a square wave of a certain frequency. This frequency is the number of colock cycles per second. The time required for one clock cycle is I divided by the clock frequency. The speed of a microprocessor is directly proportional to the clock frequency.

For instance, the clock attached to the 8088 in the PC and PC-XT runs at 4,770,000 cycles per second, or 4.77 MHz. The time required for one clock cycle is 1 divided by the clock speed, or .00000210 seconds, more conveniently referred to as 201 nanoseconds. The NOP instruction shown in Figure 1 requires three clock cycles, or 630 nanoseconds.

The PC AT comes with an 80286 microprocessor and is available with either a 6-MHz or an 8-MHz clock. The corre-

Number of Clock Cycles for Sample Machine-Code Instructions

			Microprocessor					
	Machine-code Instruction	Description	8086 and 8088	V20 and V30	88186 and 80188	80286	80386	
	NOP	No operation (do nothing)	3	3	3	3	3	
	ADD AX,100	Add 100 to register AX	4	4	4	3	2	
	LEA SI,[BX+DI+1]	Load effective address	14	4	6	3	2	
	JMP label	Jump to near address	15	13	14	7	7	
	ROL AX,CL	Rotate AX (CL = 12)	56	19	17	17	7	
	IMULBX	16-bit integer multiply	128 to 154	41 to 47	34 to 37	21	9 to 22	
	IDIV BX	16-bit integer	165 to	38 to	53 to	25	27	

Figure 1: The 8088 microprocessor used in the IBM PC and XT has the slowest execution times of all the Intel and NEC 16-bit microprocessors. The differences are particularly large in the more complex instructions such us integer multiply and divide.

sponding clock cycle times are 167 nanoseconds or 125 nanoseconds, respectively, so the NOP executes in 501 or 375 nanoseconds. That's not much of an improvement, but look at the IDV instruction: A 4.77-MHz 8088 takes at least 34,650 anaoseconds, while an 8-MHz 80266 does it in 3,125 nanoseconds—more than ten times faster.

As many AT owners have discovered. the crystal oscillator that clocks the 80286 in a PC AT is socketed on the AT system board and can easily be replaced with something faster. This simple speed upgrade is not possible on the PC and XT, however. The PC and XT system board has only one crystal oscillator clocking at 14.32 MHz. This clock speed is divided by 3 to get the 8088's 4.77-MHz clock speed. This 4.77-MHz signal is further divided by 4 to get a 1.19-MHz signal for the realtime clock. The 14.32-MHz signal appears on the expansion bus and is picked up by the color/graphics adapter for the dot clock. In short, the clock speed is just too closely tied in with the rest of the operation of the PC to make it easily replaceable. On the PC AT, however, separate crystals are used for system purposes and to clock the 80286.

But an accelerator board can effectively separate the microprocessor clock from the

system clock much like the PC AT does. Many of the smaller accelerator boards do little more than just this (see "The No-Siot Alternative to Acceleration (And Why It Makes Sense)" in this issue). So, even if an accelerator board uses an 8088 like the one you already have in your machine, it can speed up your PC by clocking it faster.

BUT NOT TOO FAST Of course, there are limits. Microprocessors are rated to operate reliably only up to a particular clock frequency. Those processors rated to run at faster clock frequencies are more expensive. Most accelerator boards come with microprocessors that can run faster than 4.77 MHz.

You can determine the speed rating of an Intel microprocessor by a suffix that follows the model number, usually printed right on the chip. As you can see in Figure 2, however, these suffixes are sometimes inconsistent and confusing.

The speed rating of a microprocessor determines only the maximum speed at which it can be clocked. When clocked at 4.77 MHz, the regular 8088 (rated at 5 MHz) and the 8088-2 (rated for 8 MHz) will perform identically.

WAIT A FEW NANOSECONDS
Aside from the speed limitations of the microprocessor, all the hardware components that the processor must communicate
with (including expansion boards, input
and output boards, and memory) have
their own speed limitations. Even if an accelerator board uses a fast clock and a microprocessor rated to run at that clock
speed, it would still come up against obstacles.

Memory is the most serious. Memory characteristics are rated by access speed in nanoseconds. In various PCs, XTs, and ATs, you'll find memory chips rated for a 250-, 200-, 150-, 120-, or 100-nanosecond access time. An accelerator board must be prepared to deal with slow memory and to do something about it.

The PC AT already does something about it. I mentioned earlier that an 80286 normally requires two clock cycles to read or write a byte in memory. On the PC AT, however, memory accesses actually take three clock cycles. Since the memory on the PC AT system board is not quite fast enough to respond to a two-cycle access time, the hardware of the AT system board inserts a will state into memory accesses.

Wait states are additional clock cycles that external hardware requests from the microprocessor to effectively slow down

Suffixes Indicating Microprocessor Clock Speeds

5 MHz	6 MHz	6 MHz	10 MHz	12.5 MHz	16 MHz
8088		8088-2			
8086		8086-2	8086-1		
		80188	80188-10		
		80186	80186-10	80186-12	
	80286-6	80286-8	80286-10		
				80386-12	80386-16

Figure 2: Intel indicates the maximum clock speeds of its microprocessors by a suffix, but the numbering scheme isn't very consistent. These are taken from Intel's 1986 Microsystem Component Handbook.

SPEED UP YOUR AT

Here's how to have the fastest AT on the block.

Like most AT owners, I firmly beclieve that fast is good and faster is better. But the classic approach to speeding up an AT is to throw in a faster clock crystal, and I've hesistated to do that because of the occasional program that might get confused by the faster clock speed. Besides, I thought the AT was already fast enough.

I was wrong, of course, as proven by the AT TurboSwitch II from Megahertz. Corp. and the 287Turbo from MicroWay. Since the issue here was speed, project manager Charles Petzold thought it would be time to try both procision the same AT at the same time. I agreed, it wasn't my AT we were messing with.

AT TurboSwitch II

The AT TurboSwitch II is a strangelooking contraption with far too many wires leading to various parts of the AT. The TurboSwitch itself fits in a rectangular cutout in the back of the AT system unit. (Does anybody know why IBM put the cutout there?) Once installed, it gives you three new controls to furmble with while reaching into the back of your system unit.

The first control is a toggle switch for shifting between turbo mode and standard AT speed. Because some programs may whiz by too quickly at higher speeds, this switch gives you a significant advantage over changing the clock crystal in the system.

crystal in the system.

The second control is a reset button.

This option is unrelated to the turbo feature, but it is welcome nonetheless—especially for those of us who fondly remember the hardware reset in the days before IBM provided us with the Ctri-Alt-Del alternative.

The third control is the most interesting. It's a rotary switch that lets you choose your clock speed. All the way up

to 12.5 MHz. Like a car speedometer that goes to 250 mph or an odometer with seven digits to the left of the decimal point, the TurboSwitch promises more than it can possibly deliver. The problem isn't with the TurboSwitch but with the AT itself.

As the TurboSwitch manual points out, a chain is only as strong as its weak-est link, and a computer system can only go as fast as its slowest component. A 12.5-MHz clock speed far exceeds the rated specifications for the AT, and the odds are high indeed (approaching certainty) that something will cry uncle (or parity error) before you get anywhere near that speed.

TRICKY INSTALLATION Unfortunately, before you can use the AT Turbo-Switch II you have to install it, and, if you have large hands like mine, that may be a problem.

As I've already mentioned, the TurboSwitch has far too many wires leading out of it. A so-called easy-hook connector (more on that shortly) clips to the clock crystal. Three more wires run to a connector that fits in the 80287 socket. (An 80287 can plug into the connector, piggyback-style.)

Two more wires run from the reset button. One ends in a grounding lug and goes on the screw that holds the Turbo-Switch in place. The other ends in a second easy-hook connector that clips to a pin on the chip in the U108 socket.

puriodize cup in the Crosscore.

The easy-hook connector is an interesting device—think of a spring-hooded by the control of t

SETTING THE SPEED Once it's listabled, you simply craine up the Turbo-Switch to the highest speed your AT can handle without crashing. In the PC Magazine Labs tests, we managed flaky operation at 9.4 MHz and rock-solid operation at 9.4 MHz and rock-solid operation at 9.5 MHz. With either setting, the extra speed was immediately obvious just from watching things happen on the screen. During the PC Labs tests, the speedded-up machine consistently observed the property of the

(The 8.9-MHz and 9.4-MHz clock speeds were reported by a test program and were slightly different from the markings on the dial-selector switch. The board uses a binary-rate division technique rather than discrete crystals.)

At the 9.4-MHz setting, it appeared that the 80286 was not correctly executing some code, so we decided to replace the 80286 with a 10-MHz version of the chip. This is another fun job and requires



Megahertz Corp. 2681 Parleys Way, Bldg. 2-102 Salt Lake City, UT 84109 (801) 485-8857 List Price: \$124.95; utility software,

Process 124-93, dutiny software, \$19.95 Requires: PC AT. In Short: A switch-selectable clock for your AT's 80286 lets you experiment to see

just what speed your AT can tolerate.
CRCLE 655 ON READER SERVICE CARD

287Turbo

MicroWay Inc.

P.O. Box 79

Kingston, MA 02364 (617) 746-7341 List Price: 8-MHz version, \$369; 10-MHz version, \$450

Requires: PC AT.

In Short: It won't improve the speed of your 80286, but the 287Turbo corrects a wiring shortcut on your AT system board and russ 80287 math coprocessor opera-

tions faster.

CIRCLE 664 ON READER SERVICE CARD

unbolting the hard disk support to get at the socket. The chip was in there so securely that we knew there must be a person on the AT assembly line whose sole job was to install the 80286 in its socket using a 50-pound sledgehammer. With a 10-MHz 80286, the 9,4-MHz speed owrked better but still had problems.

287Turbo

While nursing my wounds from installing the TurboSwitch, I bravely moved on to MicroWay's 287Turbo. As the name implies, this gadget is concerned strictly with the 80287 math coprocessor.

with the 8028 / main coprocessor. What's wrong with the provision for an 80287 already on the PC AT system board? Plenty, IBM chose to wire the 80286 and 80287 together in the simplest manner possible. This method uses the same clock oscillator (12 MHz in a 6-MHz AT) to drive both the 80286 and 80287, The 80286 divides it by 2 (to get

the 6-MHz operating speed), and the 82027 divides it by 3, which reasons 82027 divides it by 3, which reasons the mult opprocessor is working at a patretic 4MHz. Since 8-MHz and 10+8 80287s, are now available, this is a teal waste. The 287 Tittob simply provides waste. The 287 Tittob simply provides an alternative wiring of the 80286 it is available with either a 24-MHz or 30-MHz crystal to drive the coprocessor at 842 or 10 MHz. We tested the 8-MHz version of the board.

The 287Turbo is a small L-shaped board that plugs into the 80287 socket. To install the 287Turbo, you have to unplug one of the AT's power cables and plug it into the board, then plug a cable from the board into the standard power cable connector. A reset button attaches at the new bole cover.

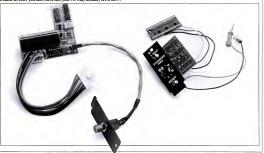
In the PC Labs tests, the 287Turbo speeded up floating-point calculation using the 80287 by about 50 percent when used by itself, and speeded it up by roughly 90 percent when used along with the TurboSwitch. The extra speed gained with the TurboSwitch indicates that the test is not 100 percent bound to the 80287, but it may better reflect realworld applications. (The test program was written in C and compiled with the Microsoft C compiler, Version 3.0.)

The only problem I ran into with these products was that the additional speed was far too attractive. For the first time, my AT seemed slow, and I'm going to have to do something about that.

These products have also reminded me how nice it is to have a reset button, which brings up an interesting point. According to MicroWay's Stephen Fried, this feature has been responsible for 'our largest order to date—from IBM in Boca. They are developing code and need the mest."

Now, if you'll excuse me, I have to go and install something on my AT. —M. David Stone

If you think your AT is already fast enough, think again. These two little devices, the ATTurbaSwitch II (from Megahertz Corp.) and the 28TTurbo (from MicroWay), don't exactly use classic approaches to speeding up your AT, but they are good for a fair amount of fun. Only trouble its, once you take them out, your AT may avantuly seem slow.



■ ACCELERATOR BOARDS

memory or I/O access. At first impression, a wait state may sound like a crude fix for the problem of incompatible processor and memory speeds, but wait states are a very common part of hardware design. One of the input signals to the microprocessor is dedicated to force the processor to insert wait states into memory accesses.

Accelerator boards are so fast that sometimes they have to insert four or five clock cycles into memory accesses. It may seem as if an 8088 clocked at 9.54 MHz (twice the normal rate of 4.77 MHz) with memory accesses requiring eight clock cycles (four normal and four wait states) would run the same as 4.77-MHz of the control of the co

THE DATA I/O FACTOR I've been talking about the pair of microprocessors called the 8086 and 8088 (and the 80186 and 80188) as if they were the same. They are very nearly the same, but only internally. All Intel 16-bit microprocessors can internally manipulate data 16-bits long (often called a "word"). It's how they move this data in and out of the microprocessor that makes the difference.

The 8088 and 80188 speak to the ress of the world (the other components inside your machine, including memory) in 8-bit bytes. When they access data in memory, they do it a byte at a time. The 8086, and 80286, however, speak in words. They can store or read data 16 bits at a time. The 80386 can access 32 bits at once.

Sometimes word accesses cause a big improvement in speed, but sometimes they do not. The best-case speed advantage of an 8086 over an 8088 clocked at the same speed is precisely double. The worst case is that they will run at the same speed.

For instance, when a word processing program works with text stored in memory, each character takes up 1 byte of storage, so the program will often use byte accesses. For these accesses an 8086 will not show much improvement over an 8088. The opposite extreme is numeric calculations where numbers are often stored units of words or longer. Instruction

fetches also generally occur twice as fast with an 8086 or 80186.

Another way an accelerator board may try to beef up speed is by using an 8086 instead of an 8088. However, this presents another problem, because the rest of your PC or XT is based on byte accesses, and there's not much you can do about it.

The bus through which the processor communicates with expansion boards (including memory) has 62 signal lines: 8 are used for power and grounding, 20 are for the 20-bit address, 2 are clock signals, 6 are interrupts, 7 are involved with Direct Memory Access (DMA), 10 are for timing and miscellaneous uses, and 1 is reserved.

 Small-size boards don't require a slot and offer little more than a faster clock speed.

That leaves 8 for data. That's a physical restriction.

If an accelerator board uses an 8086, 80186, or 80286, the board itself has to generate 2-byte accesses from every word access coming out of the microprocessor. This process cuts the potential doubling of speed right in half, so you're right back where you started.

Accelerator boards can get around this problem by including their own memoy right on the board. They can ignore the memoy on your 256K-byte system board and your 384K multifunction board and use 640K of their own memory instead. The 256K memory chips common tody let this 640K take up only about a quarter of a full-length accelerator board. Since the microprocessor doesn't have to go the microprocessor doesn't have to go this control of the microprocessor doesn't have to go this control of the microprocessor doesn't have to go this control of the microprocessor doesn't have to go the microproceso

An accelerator board that uses its own memory has other advantages as well. While an accelerator board may normally have to insert wait states to use memory from your system board or an expansion board, it can avoid these wait states if it uses high-speed memory installed right next to the microprocessor. This configuration allows engineers to cut design corners more closely and get as much speed as possible out of the board. Instead of sending out a signal to the system bus and having it bounce around and shoot up into a lot of old boards, the memory could be just a few inches away. It helps.

However, accelerator boards must then find some way to deal with DMA logic on the system board. The DMA circuitry takes over when a disk access occurs to transport data between memory and the disk controller more quickly. The DMA expects to find the memory on the system board instead of on an accelerator board.

Your PC or XT system board also contains a BIOS (basic input output system) stored in ROM. The ROM is generally slower than random access memory, but it is used extensively for simple screen output and interpreter BASIC. To get around the speed limitation involved in accessing this ROM from the board, some turbo cards have a provision to transfer the contents of this ROM into the memory on the seothers of the speed of the speed of the speed seothers of the speed of the speed of the speed of the speed seothers of the speed of the speed of the speed of the speed speed of the speed of the speed of the speed of the speed speed of the speed of the speed of the speed of the speed speed of the speed of the speed of the speed of the speed speed of the speed speed of the speed speed of the speed of the

THE QUICK-CACHE COMPROMISE Of course, once we start talking about an

Of course, once we start talking about an accelerator board with its own 640K bytes of memory, we're starting to talk about big bucks—possibly the type of bucks that tells you it would be best in the long run to buy a PC AT.

There's a compromise approach, however, that often shows up in less expensive half-length boards. These boards include only a very small amount of high-speed memory, generally 4K to 8K. They use this memory for caching.

Here's how they work: When the microprocessor on the accelerator board reads data from system memory in byte accesses with four or five wait states inserted, the board hardware also writes the data into the memory reserved for eaching. The next time it reads that data, it need not read from system memory, but it can read directly from the cache with word accesses and no wait states.

At any one time, this cache can hold only 4K or 8K bytes of the total 640K of system memory. It may at first seem as if the cache is just not big enough to significantly improve speed. Not true. Memory caching works because most software spends much of its time in small loops, executing the same set of instructions many times over before moving to something clse. If any software loop is longer than the size of the memory cache, eaching will not work for that loop. But memory caching usually works very well.

However, when improperly implemented, memory caching may cause other problems. For instance, bank-switched memory used in boards supporting the Lotus/Intel/Microsoft expanded memory specification (EMS) cannot work if the EMS section of memory is cached. The accelerator board has no way of knowing that another bank of memory has been selected in the same memory space. Another board with which eaching can wreak havoc is the Enhanced Graphics Adapter. Like bankswitched memory, the EGA's 256K bytes are organized into color planes accessible through a single 64K window. The color planes are specified by values written to output ports that the accelerator board cannot interpret.

TYPES OF BOARDS There are, to my mind, three categories of turbo boards for PCs and XTs: small, medium, and large. You can also think of them as fast, faster, and fastest—or cheap, reasonable, and ex-

In "The No-Slot Allemative to Accelention (And Why I Makes Sense)," Stephen Davis discusses the small-size bounds in more detail. In general, these boards do not require a slot and offer little more than a faster clock speed and perhaps a NEC V20 instead of an 8088. They usually include jumpers to specify different clock speeds or to insert wait states into memory accesses. We reviewed the Mayanard Surcesses. We reviewed the Mayanard Sursection of the state of the state of the Speed Fast88, Overthruster, and the American Turbo.

The medium-size boards generally require you to put the board into an expansion slot, remove the 8088 microprocessor, and run a cable from the board to the now-empty socket on the system board. Medium-size boards can use anything from a fast 8088 to an 80286 and often include memory caching to supplement the faster processor and clock speed. Those reviewed here include Quadram Quadsprint and SuperSprint, Orchid TinyTurbo 286 and TurboEQA, Microway 286 Turbo-Cache, Victor SpeedPac 286, and PC Technologies 286 Express Card. Also in this category is the oddball Microway 87/88 Turbo Board, which is more like a small card though it takes up a slot.

The large-size boards generally use their own memory and may not even require removing the 8088 from its socket. We tested Earth Computers Turbo Accel-286, Microway Number Smasher/ECM, Classic Technology 286 Speed Pak, Orchid PC Turbo-286e, and the Applied Reasoning PC-elevATor. These boards disable your system board 8088 through a DMA channel and take over your whole system. Sometimes they seem like a whole separate computer in your machine. In fact, some of them may contain the hardware rudiments for multi-tasking and parallel processing. Software support is a whole other matter.

ACCELERATION PROBLEMS 1BM's series of personal computers was not designed to allow for easy substitution of the microprocessor or crystal. The installation of a turbe card causes a radical change in the function of a machine. Typically, you can't just put an accelerator board into your PC or XT and then sit back to enjoy the new speed. Chances are, you'll discover problems unlike any you've encountered before. In general, the more complex the content of the property of the

the board, the more problems you'll find. Some of these problems arise with applications software that expects to operate at a particular speed. Games are the most obvious example; some of them will present new challenges (and perhaps new fun). Many of the more "advanced" forms of copy protection are also speeddependent, which may prevent you from using a program at the higher speed. Printer and modern time-outs may be common. Software often uses loops to determine how long to wait for a printer or modem that cannot yet accept more data. If the loop goes too fast, it will terminate prematurely. With some turbo boards, you won't even be able to format a disk.

For very large, complex boards, the problems become more esoteric and unusual. Some of these boards may reveal

What? No SysInfo?

On test we did not run on the accelerouter beands is systline, which is part of The Norton Utilities. Versions 3.0 and 3.1. Among other things, Systline reports a "Performance Index" of processor speed. A normal PC or XT ranks at 1.0 and a 6-MHz PC AT gets awarded a 5.9, meaning that it's almost six times faster than a PC. A NEC V20 in a standard PC or XT gets a 1.8 from Systline, meaning

that it's 80 percent faster than an 8088.
These numbers from SysInfo are excessively high. They are higher than anything you'll get from using a PC AT or a V20 and higher than most other measures

of processor speed will indicate. Here's why: The loop that SysInfo times for the Performance Index contains just a few instructions, but among them are an IMUL (integer multiply) and IDIV (integer divide). In actual program machine code, the IDIV and IMUL are fairly rare. They occur in arithmetic calculations, of course, and in array indexing, but you can write entire programs without any IDIV or IMUL instructions at all. Since these two instructions run very slowly on an 8088 and faster on the other Intel and NEC microprocessors, SysInfo greatly exaggerates processor-speed improvement over an 8088.

We told several manufacturers that we would not be running Syslinfo for the accelerator boards, and they all applauded our decision. It remains to be seen, however, whether they will continue to use Syslinfo results in their advertising. —Charles Petzuld

software bugs that no one has ever found before. For instance, the 80286, in particular, generates several types of internal interrupts that are helpful for an operating system that implements protected mode, but which nobody cares about right now. An 80286 on an accelerator board could easily stumble onto these internal interrupts.

Fortunately, many of the boards can be switched out of turbo mode if trouble arises. The non-turbo mode either operates at the same speed as your PC without



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CIRCLE 352 ON READER SERVICE CARD



The 286 Express Offers AT Speed

By Garry Ray

If you're on the verge of tossing your PC in favor of something faster, hold on a minute: There's an add-on coprocessor that will give you much the same performance of an AT. The 286 Express, from PC Technologies, is probably the most useful

Iechnologies, is probably the most useful "speed-up" board that we've seen to date. The 286 Express gives complete PC compatibility without the mess and bother of start-up device drivers, memory allocation switches or strange performance limitations that often make other boards too oppressive for the general user. In short, this is the board to consider if you want increased speed and utility for your PC.

At the heart of the unit is an 8MHz Intel 8026 microprocessor, supported by a mere handful of ICs and a 40-pin connector (with cable) that plugs into the slot normally occupied by the PC's 8088. In fact, once you've installed the 286 Express, it will act in exactly the same manner as the 8088, albeit faster. With the assistance of on-board Programmable Array Logic (PAL), high, the processor obtains a click speed of 7.2MHz from the 14.3MHz color-burst signal on the PC's expansion but

signal on the PC's expansion bus. Beyond the speed of the 80286, many of the performance improvements of the 286 Express are due to an on-board 8K-byte memory eacher that accumulates instrucments of the speed of the speed of the speed Since the cache is located on the Express board itself, close to the 80286 microprocessor, PC Technologies was able to force continual program execution with no wait states. BMY SAT, which must seek instructions from relatively distant system memory of through the 16-bit system bus, must yet from the speed of the system bus, must yet from the speed of the system bus, must yet from the speed of the system bus, must yet from the speed of the system bus, must yet from the speed of the system bus, must yet from the speed of the system bus, must yet from the speed of the system bus, must yet from the speed of the system bus, must yet from the speed of the system bus, must yet from the speed of the system bus, must yet from the speed of the system bus, must yet from the speed of the system bus, must yet from the speed of the system bus, must yet from the speed of the system bus, must yet from the speed of the system bus, must yet from the speed of the system bus, must yet from the speed of the system bus, must yet from the speed of the system bus, must yet from the speed of the system bus, must yet from the system of the system yet from the system of the system yet from yet fro

one wait state.

The Express continually monitors program flow and swaps segments of code into and out of the memory cache. For example, if the program has a large 'loop' that can execute within the 8K-byte cache, performance for that section of code will be fairly high—in fact, at the physical limit of processing speed for the 80286 running at

7.2MHz. If, on the other hand, the program has large, non-contiguous code sections that exceed the 8K-byte cache, then performance will be constrained by the requirement to get that code from the PC memory bus into the cache. In any case, performance will always be markedly better than

the PC running with an 808.
Some programs may run into problems with the cache. Since the cache appears to some process may be caused to the cache special to the cache memory). Other programs, primarily copy-protection of the cache special to the cache special

Brief Instructions

After opening the 286 Express packaging, you might be inclined to ask, "Where's the rest?" That's because the entire outfit consists of a half-slot PC board, a chip puller and an incredibly brief 12-page installation and instruction manual.

Typically, this sort of product might include a loppy disk with one or more device drivers, a full-islot board louded with processors, chips and other electronic circutry and a tome chock-full of rather technical installation and operational instructions. Not so with the 286 Express—it's a simple plug-and-go performer that dispenses with the normal raf of technical considerations.

To get the board running, you simply remove the SISBs with the primitive but functional chip-puller and insert the 286 Express connector Caution is the key word here, because the chip-puller is more a scaled-down crowbar than anything else. It is not at all difficult to bend the pins of the MSBs using the device. The same is true when installing the circuit replacement; it's relatively easy to bend the pins of the plus.

relatively easy to bend the pins of the plug-However, once the board has been installed, it functions as the PC's main strike that, only—processor at speeds of two to four times greater than the unadorned PC. In fact, with most applications, the 286 Express turns in processing times even greater than IBM's standard 6MHz AT.

In our tests, we measured the performance of the Express against a number of other coprocessor and "speed-up" boards, in addition to the PC, AT and an AT-compatible running at both 6 and 10MHz. (The standard 1BM AT runs at 6MHz)

The results clearly showed that the Express was not only faster than all the PC add-on boards tested by PC Week, but faster than the IBM AT. In fact, most tests showed the Express running at speeds somewhere between those of the AT at 6 and 10MHz. The conclusion of our tests is that the 286 Express turns in speeds roughly equivalent to those of an AT or compating

be running at 8MHz.

On the other hand, disk operations are not greatly affected by the Express. This is not a limitation of the board, but rather a physical limitation imposed by the storage devices themselves. If your hard disk runs at 90 millisconds average access, then that's all you're going to get—no speed-up board can improve disk performance.

However, since the Express will process disk-bound commands (those that control disk access) faster than normal, there will be some measure of improvement in overall performance of disk-intensive programs. Our Disktest, for example, improved by about 15 to 20 percent solely because of the

presence of the Express board.
Compatibility with a variety of peripheral boards was well proven in the four weeks we used the Express. In not a single instance did we experience any problems with add-on boards of any type, including some of the new expanded memory boards, moderns and local area network adapters. Causing absolutely no problems with all the software and hardware we testing

The 286 Express is an elegant solution to a pressing problem—how to get more bang for the buck from a PC. For many users, it could be the alternative to purchasing an AT, bridging the gap between the PC and the next generation of 80386 machines due in 1987.

But whether you intend to upgrade in the future or not, the 286 Express should prove a handsome solution to any concerns about PC performance.

I WEEK OATABOX

Product: 286 Express

Category: PC accelerator board

Who should buy: Those desiring increased performance from an IBM PC or XT

Description: 286 Express adds increased performance to an IBM PC or XT

Distribution: Retail and direct

Company: PC Technologies Inc. 704 Airport Blvd. PO. Box 2090 Ann Arbor, Mich. 48106 (313) 996-9690 (800) 821-3086

286 Express Benchmark

	Sieve	Video Scroll	Squarea	Lotus 1-2-3 Multipli- cation	Payments	Squares
286 Express	13	9	23	4	13	26
PC 4.77MHz	54	11	1:12	10	34	1:25
AT 6MHz	16	7	28	3.5	12	26
AT10 MHz	10	3	17	2	7	17
Orchid	22	5	39	5	16	40

PC Technologies' 286 Express: Turns in speeds comparable to an AT running at 8MHz.

ACCELERATOR BOARDS

the accelerator board or emulates that operation. Switching between the modes will require a reboot if the turbo board must switch between two different microprocessors. Some boards that can be switched on the fly may include programs or a keyboard combination that handles this switch.

THE COPROCESSOR PROBLEM Right next to the 8088 socket on the system board of a PC or XT is another socket for an optional Intel 8087 Numeric Processor Extension, also called the floating-point math coprocessor. The PC AT has a socket for a similar 80287 chip.

Software can take advantage of an 8087 or 80287 to speed up floating-point calculations. (For instance, 1-2-3, Release 2, supports an 8087, Dut Release 1, A did not, Ironically, accelerator boards run into the most problems in offering full support of a math coprocessor. If this is important to you, then you should read very carefully what the reviewers have to say about the boards in this read.

boards in this regard.

Part of the problem comes from 8087
and 80287 error handling. An error in the
math coprocessor is generated by operations like a division by 0, overflow or underflow, and taking the logarithm of a nonpositive number.

Programs can handle 8087 errors in several ways. They can continually check what numbers they load into the math opprocessor so that errors never occur. They can ignore errors, because the 8087 will give a "reasonable" result for every calculation. Software can also check the status giptes i Tolorovie every 8087 calculation to see if an error has occurred. This latter reptactive they are the second of the status of the second of the second of the second results and the second of the second of the status of the second of the second of the status of the second of the second of the status of the second of the status of the second of the se

The most sophisticated and fastest way for software to handle 8087 errors is to program the coprocessor to generate an "cz-cuption interrupt" whenever an error oc-curs. A separate interrupt routine then deals with it. On the IBM PC, the 8087 is wired to generate a non-maskable interrupt. (NMI) for this exception interrupt. Switch 2 on the system board DIP switch lets this signal pasts to the 8088.

An accelerator board that uses an 80286

cannot use the 8087 on the system board but instead must include an 80287 to provide the same floating-point hardware support. Often, however, the exception interrupt of the 80287 is not implemented the same way. Programs that use the interrupt method for handling errors will not work right.

Microsoft's C, FORTRAN, and Pascal compilers all use the exception interrupt approach to error handling. (Of course, if you buy an applications program that uses an 8087, you probably won't know what it

The marriage of a PC or XT with an accelerator board is an unnatural and often hostile union. It's surprising that such marriages work at all.

was programmed in.) Suppose the accelerator board does not properly enable the exception interrupt line and you use a program written in C., FORTRAN, or Pascal compiled with the Microsoft compilers: if this program at some time attempts to take the logarithm of 0 (or something else that generates an 8087 error), the program will hang and you'll have to reboot. It's as simple as that.

WHAT THE BOARDS WON'T DO If you're looking only for improved processing speed, an accelerator board will give it to you. If you're looking for anything else, you're going to be disappointed. In short, accelerator boards will not turn your PC or XT into an AXT.

Accelerator cards will not significantly improve disk access speed. They will improve the software overhead required for file I/O, but once the red light goes on, your disk will not work faster. We ran file I/O tests on all the accelerator boards reviewed here and found no real improve-

If you have been thinking about getting

an accelerator board with an 80286 to take advantage of the forthcoming "Future DOS" (Microsoft's term) that will run in 80286 protected mode and access 16 megabyes of memory, you can forget it. The boards that do not have their own memory because every through the 200 memory through the 200 memory through the 200-bit address lines on the system board base.

Some of the larger boards can currently with to protected mode using their own memory on the board, but even here it's quite improbable that this memory will be accessible in a protected-mode DOS. Future DOS will probably have to take over the whole machine in protected mode and will not be able to recognize the accelerator board. Even if it did, you would be limited to the memory you could actually install on the board.

WHAT THEY'RE REALLY LIKE Although I've been discussing turbo boards mostly in the abstract, by now you should see that the marriage of a PC or XT with an accelerator board is an unnatural and often hostile union. It's surprising that such marriages work at all.

Accelerator boards, in general, rate fairly high on the "fritter factor" scale. PCs and XTs were not designed to accommodate easy replacement of the micro-processor. The reviewers working in the PC Magazine Labs had to strangle with re-calcitrant cables, bent (and sometines bro-ken) pins, and large hands trying to fit into small spaces. In general, everyone was thankful that we were experimenting on

PC Labs' machines instead of our own. Twice during this testing, two XTs installed with different accelerator boards developed damaged hard disk file allocation tables. This is a serious problem if you value your files. In one case the hard disk, had to be reformated. We couldn't directly trace the cause back to the accelerator boards, but they sure locked culti-

"To accelerate or not to accelerate" is not really the question. The question is "How?" As for me, I've discovered that there's really only one way to get an AT on my desk, and that is to buy one.

Charles Petzold is a contributing editor of PC Magazine.



CHEETAH COMBO/70

Does IBM really manufacture an IIMhz PC-AT? Yes... and so does Compaq, Hewlett Packard . . . and every other manufacturer of PC-ATs that run at a clock speed of 8Mhz.

We are not suggesting that the manufacturers are shipping their ATs with a clock speed of 11Mhz – they could not. The current products simply would not be reliable at that speed.

What we are saying is simply this, "the IBM PC-AT was designed to run at an equivalent clock speed of about IIMhz."

So how do you make an 8Mhz IBM PC-AT out-perform the new IOMhz "SUPER" ATs? Easy... you let the IBM PC-AT run at it's natural "NO WAIT STATE" speed.

IBM designed the PC-AT to run with "NO WAIT STATE" memory on the bus – it has been there all along. The only missing ingredient has been a super reliable memory board with "NO WAIT STATE" logic and ultra high speed DRAMs.



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For those of you that have not had an opportunity to evaluate the new no wait state ATs . . . a quick explanation of NO WAIT STATE will be of interest.

Because the memory in the IBM PC-AT (as well as most other ATs) is too slow – the system must spend 33% of each memory cycle "WAITING". In effect, the IBM PC-AT memory cycle looks like this ... work, WAIT, work ... work, WAIT, work

The super fast 70ns DRAMs and "NO WAIT STATE" logic in the Cheetah Card and the Cheetah Combo allows the single wait state IBM PC-AT to run NO WAIT STATE. You can think of our memory as running ... work, work ... work work. Cheetah Memory requires no wait states.

Cheetah Memory is 33% FASTER!

Compatibility? Cheetah boards are guaranteed to be 100% IBM hardware and software compatible . . . period.
(We also guarantee our boards to be compatible with the next generation of

DOS.)

Reliability? The AT will have exactly the same super reliability as before . . . exactly. The AT is not modified in any way. Cheetah Memory simply runs more efficiently!

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Cheetah International, Inc.
107 Community Boulevard, Suite 5
Longview, Texas 75602 USA

So how do you convert any slow "out-of-the-box" 8Mhz PC-AT into the world's fastest? Easy . simply plug in a 1.5Mb Cheetah Combo!70 with scrial and parallel ports. . . or a 2.5Mb Cheetah Card!70 . . . we take

care of the rest. It's that easy!	
AutoCad™ DEMO	SEC.
STANDARD 6 Mhz IBM PC-AT	114
STANDARD 8 Mhz IBM PC-AT	80
10 Mhz CLONE	66
STANDARD 8 Mhz CHEETAH MEMORY IBM PC-AT INSTALLED	61

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- at 12 Mhz with one wait state!



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processor

 ACS MS-DOS 3.2 GW Basic 3.2

A HERITAGE OF EXCELLENCE in any marketplace one product stands out as the pinnacle of performance and value. In the PC/XT marketplace, that product is the ACS-1000: 4.77 or 8 MHz operation, 1 Megabyte memory, built in communications, built in floppy disk controllers, even a SASI interface—all packaged on a single board and priced competitively with the merely compatible.

Building on the heritage of the ACS-1000, the ET-286 plus brings the same standards of excellence to the AT marketplace.

CIRCLE 106 ON READER SERVICE CARD IBM, UMX and XENIX are trademarks of IBM, AT&T and Microsoft respectively **Push Back** The Envelope: 10/6 & 12.5 MHz AT Compatibility

IBM obviously positioned the AT as the hub of the microcomputer network ACS has included what IBM

left out. SPEED The ET-286 nearly doubles the clock speed of the AT at 10 MHz and we are already 12.5 MHz capable. With access to 4 Megabytes of on-board memory via a 5MHz DMA bus, the ET-286 bypasses additional wait states required to maintain compatibility with expansion bus memory. With memory intensive network software like Unix and Xenix, this becomes critical. Naturally the ET-286 toggles from Hy-perSpeed at 10MHz to 100% 6MHz compatibility for those

COMMUNICATIONS The ET-286 plus is designed with communications in mind. There are three on-board serial ports that are configurable as either RS-422 or RS-232 depending on your application. 2 parallel ports further extend your communications ability. And there are still 8 expansion slots for additional I/O.

applications that demand it.

Part of the success of the ACS-1000 and our other products is the availability of our people. We provide the support that OEM's need in order to win major contracts engineering support, competitive pricing, ever specialized packaging. Service is the key issue in the information marketplace and we provide the kind of service and reliability that you can only find in an American

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information, call or write: ACS International, Inc. 2105 Luna Rd., Suite 330 Carrollton, Texas 75006

214-247-5151 TELEX: 709748 ACS UD

87/88 Turbo Board

If you like to tinker with your PC, you'll love MicroWay's 87/88 Turbo Board. This motherboard accelerator offers a combination of tricks to speed up your PC and leaves it to you to find the optimum speed.

The 87/88 Turbo Board package includes an 8-MHz NEC V20, three clock crystals, and an optional 8088 Turbo Board for the motherboard. The board itself is a half-card that plugs into an expansion slot and includes a short cable that replaces the 8284 in the clock chip socket.

MicroWay says it considers the board a hacker's device. One reason for the label is that before installing this board, you may have to modify your motherboard. The 8284 clock chip is soldered on some IBM PCs and socketed on others. If it's soldered, you'll first have to unsolder the chip and solder a socket on the board.

Whether or not you feel comfortable with this idea, you should probably check out your 8284 clock chip before you buy the board. On the PC, the 8284 chips is alongside the power supply—between the power supply and the expansion slots. On the XT, the 8284 is in the same general area, but it is further away from the power

Even if you start with a socketed 8284, installing this board takes more tinkering than do most expansion boards. First you have to remove your 8088 from the system board and replace it with the NEC V20.



 Motherboard accelerators are highly machinedependent. The only way to find out how fast your machine can go is to try it.

Then you may have to shuffle the boards in your system to free up the slot closest to the 8284 socket. The 87/88 Turbo Board goes into the expansion slot, the 8284 clock chip gets pulled, and the cable from the based to be a single point of the 1828 clock.

board plugs into the 8284 socket.
And at this point, you are finally ready
to start fooling around with clock crystals.
The three crystals that come with this
board run at 20 MHz, 22 MHz, and 24
MHz, yielding system speeds of 6.7 MHz,
7.2 MHz, and 8 MHz. The 20-MHz crystal is soldered onto the board. Either of the
other two crystals can plug into a socket. A
jumper on the board lets you choose between the soldered crystal and the socket:

FINDING THE RIGHT SPEED Motherboard accelerators are highly machine-dependent, and the only way to find out how fast your machine can go is to try it. The idea is to start with the 24-MHz crystal and work your way down until you reach a speed that works. If your computer crashes, it's not working.

es, it's not working.

MicroWay says that most IBM PCs
will run at 6.7 MHz, a "goodly percent
age" will run at 7.2 MHz, and most will
not run at 5 MHz. On the other hand, many
the result of the result of the result of the result
for the never IBM motherboards. (The mischine I used managed 7.2 MHz.) The
R788 Turbo Board does not put any wait
states into memory accesses. The main
imitation will probably result from the
speed of memory chips on your system
board or expansion board.

board or expansion board.

A MicroWay representative also pointed out that high-quality motherboards are available for ''next to nothing'' (about \$150), and that it might be worth the additional investment to replace the current motherboard in your PC. But of course it would be silly to replace the current board until you find out for sure that it won't run at 8 MHz.

BEING BRIEF In keeping with its view of this board as a hacker's device, MicroWay's documentation—I hesitate to call it a manual—consists of two pages of text. Miraculously, this single piece of paer contains all the information you need to set up the board. Still, I am sure that it would benefit tremendously from an illustration showing where to find the 8284 elock chip.

Once installed, the 87/88 Turbo Board is simple to use. When you boot up, the machine runs at the standard 4.77 MHz. There is a toggle switch on the back of the board that lets you switch to the faster speed—down for fast and up for standard PC speed.

More convenient is a memory-resident program that comes with the board and lets you switch speeds with Ctrl-Alt-P and Ctrl-Alt-L. The idea is to load the memory-resident program into your AUTOEX-EC. BAT file and use it as needed. This ability to switch speeds midstream can be useful—particularly if you have programs with copy-projection schemes that refuse to let you start a program when running at the faster scene.

If the memory-resident program conflicts with anything else on your system, there is also a pair of non-memory-resident programs for speeding up and slowing down the system.

Two other noteworthy features on this board should be pointed out: a clock/calendar and a reset button. The reset button is extremely welcome for all those times when the Ctrl-Alt-Del combination refuses to reboot the system, and you don't want to power down.

And of course there is the issue of speed. On the PC Magazine Labs tests, the 87/88 Turbo Board consistently managed a speed improvement of 1½ to 2 times that of a standard PC. You won't outrace an AT with this board, but given the moderate price—\$149 without an 8087, or \$295 with it—the 87/88 Turbo Board is worth considering.—M. David Stone.



Quadsprint

If you want to soap up your PC but don't believe in going to far beyond the speed believe in Going to far beyond the speed limit, try Quadram Corp.'s Quadsprant. It is simple in design, consisting only of a 10-MHz 8086 and 41k bytes of cache, but in operation it supplies some of the benefits normally found in more-expensive units. At its opinum setting—that is, when the cache is enabled—operations show an intended to the control of the cache is enabled—operations show an intended to the cache of the cache is consistent of the intervention of the cache of the cache is a small investment for the increase in productive).

You can almost install the Quadsprint bindfolded—it shat easy. The difficult part is extracting the PC's native 808% and plugging the connecting cable into the empty socket. Fortunately, the cable is one enough to let you install the card in almost any slot; you can then drape the cable over the intervening cards. On an YI, this technique is mandasory because the first the change is in analysis of the properties of by the hard disk and floppy disk controller cards. The only other hardware installanted procedure involves setting a jumpar. The Quadsprint comes with three jumpers, but only one concerns you—the other two are for factory diagnostics and the other two are for factory diagnostics and the other two are for factory diagnostics not document either one. Presumably, if you have special installation needs, support at Quadram will walk you through the proper jumper settings. The jumper you need to set enables or disables the GR. byte cache memory, and if you forwing byte cache memory, and if you for it werry. Unlike what many other accelerator.

boards that use caching require, you do not need to disassemble your PC and pull out the card every time you need to disable or enable the cache. Quadram has supplied a software solution in the form of two oneline BASIC statements. This implementation is one that other manufacturers of accelerator boards should take careful note of-users are never too thrilled about opening their system and fiddling with its innards. The cache's implementation does present one inconvenience, though, If your XT has less than 640K bytes of RAM and the cache is enabled, you cannot warm boot. The manual recommends disabling the cache with the OUT statement and then warm booting.

SNOW WARNING Running the Quadrin when Below and presented none of the problems found with other accelerations. When it was connected to a color/graphics adapter, however, it did occasionally produce an inordinate amount of snow on the CGA. The interference appropriate of the color of the co



4355 International Blvd. Norcross, GA 30093 (404) 923-6666 List Price: \$345; optional daughterboard,

\$95 Requires: IBM PC or XT, a full slot. In Short: Quadram's Quadsprint is a low-

In Short: Quadram's Quadsprint is a lowcost full-length board that doesn't quite make it in speed but is easy to install and use. CHICLE 661 ON PEACOR SETWICE CAPID



From left to right. Orchid Technology's PC Turbo-286e, Applied Reasoning's PC-elevATor, Classic Technology's 286 Speed Pak. Earth Commuters' Turbo Accel-286, MicroWay's Number Smusher/ECM. Owadrum's SuperSprint, Orchid Technology's MicroWay's 286 TurboCache, Orchid's TinyTurbo 286, Victor Technologies SpeedPac 286, PC Technologies' 286 Quadram's Quadsprint. MicroWay's 87/88 Turbo Board

you pay with any accelerator card. However, while almost every card I tested displayed some snow, the Quadsprint produced more than I had expected. It results from the Quadsprint's very conservatively timed bus operations, which actually access the screen more slowly than those of a standard PC or XT.

These conservative bus operations also showed up when I ran the Quadsprint with caching disabled. Without the benefit of the cache, many of the performance tests ran slower than those of a standard PC or XT. The 4K-byte cache is half the size of caches on some other cards, so programs with very large loops (or lots of nested calls) will not show much of an improvement in speed.

OPTIONAL DAUGHTERBOARD 11 you use any software that requires an 8087 math compression you need to purchase

math coprocessor, you need to purchase the optional daughterboard. Although we asked Quadram to submit one for testing and a spokesperson promised to send us one immediately, it did not arrive by the time this review was submitted.

The Quadsprint manual is brief and easy to follow-almost what you would want for a user-friendly add-on. However, its appendix includes a glossary of terms that are also applicable to other Quadram products. Consequently, it contains a number of terms that have little or no bearing on the Quadsprint. The documentation also omits an index and any mention of the

also omits an index and any mention of the optional 8087 daughterboard.

The Quadsprint may not be on the cutting edge of accelerator technology, but it is dependable, easy to use, and, at \$345.

quite reasonable.—Vincent Puglia 286 Express Card

Since—for all intents and purposes—Vice to Technologies' SpeedPac 256 (reviewed in this issue) and PC Technologies' 266 Express Cand are one and the anne card, you would expect that both compares would send exactly the same bounds are sended by the carea of the control of the

problems displayed when testing the cards in EGA graphics modes are presented in this review rather than in both.

A HALF-SLOT CARD PC Technologies' 286 Express Card is a half-length card that fits comfortably into the XT's half-slots. The accelerator consists of an 80285 minning at 7.2 MHz and 8K bytes of RAM for caching. An optional 80287 math coprocessor can be plugged into the board. Installation requires removing your system's native 8088, sliding the card into



PC Technologies Inc. 704 Airport Blvd. Ann Arbor, MI 48106 (313) 996-9690 List Price: 5595 Requires: IBM PC or XT, a half-length slot

In Short: The 286 Express Card replaces your 8088 with an 80286 and 8K bytes of cache.

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■ ACCELERATOR BOARDS

an empty slot (preferably J7), and connecting the card's cable to the empty 8088 socket. Jumpers are available for telling the card how much memory is installed the system and for enabling the cache. The jumpers could be set to something lower than system memory if part of your 460K contains bank-switched memory, which must not be cached. The entire process is adequately described and illustrated in the documentation.

The testing conducted at PC Magazine Labs demonstrates that the 286 Express Card and Victor Technologies' SpeedBue 286 are identical cards. The efficiency of the caching is responsible for most of the speed improvement. For instance, the PC Labs 1-2-3 test showed virtually no improvement with eaching disabled. With caching enabled, however, it took about one-third the PC's normal time to complete.

AN EGA MODE PROBLEM The 286

Express Card tested had a problem with

the enhanced graphics modes of the EGA. For example, when scrolling text in an EGA graphics mode, every other scrolled character was displayed twice. If a directory listing showed a file named TEST .DAT, it would turn into EETTDDTT when the screen was scrolled. All the characters on odd-byte addresses were being written back to the screen at both even and odd addresses. The reason for this strange behavior is related to EGA internal registers that latch existing screen data when a byte location is read in graphics mode. For its caching logic, the 286 Express Card was apparently reading both the byte on the even address and the next byte on the odd address whenever the 80286 wanted to read a byte on only the even address. This caused the data in the EGA internal registers to be invalid. (This was a problem only in EGA graphics modes. Text modes and

fine.)
According to a spokesman, if you already own a PC Technologies' 286 Express Card and wish to ugrande to an EGAcompatible card, it is going to cost you \$100. On the surface, this publicy may seem reasonable; however, if you consider that Victor Technologies is providing its customers an even-waw upgrade, you

CGA-compatible graphics modes worked

have to begin to wonder a little.

As far as your system is concerned, any one of PC Technologies' 286 cards—whether with its own label or someone else's—provides the same performance. As far as your wallet is concerned, the Victor Technologies' SpeedPac 286 is much more palatable if you are upgrading.—Vincent Puglia

SpeedPac 286

Victor Technologies' SpeedPac 286 (the original equipment manufacturer is PC Technologies) is a half-length scolerator card that includes an on-board 80286 chip. which runs at 7.2 MHz, 8 K byes of RAM caching, and a socket for an optional 80287 math coprocessor. The SpeedPac 286 also offers casy installation and rela-

tively transparent use. If your system reflects the default jumper settings (256K bytes of RAM with cache enabled), installation consists of pulling your system's native 4.77-MHz 8088 chip, inserting the card into one of the slots near the power supply, and plugging the connecting cable into the empty 8088 socket. If you are installing the halflength card in an XT, the card slides easily into the second slot just behind drive A:. If your system requires a different settingfor example, if it has 640K bytes of RAM or you need to disable the caching-vou reset the jumpers according to the clearly labeled illustrations in the 19-page docu-

mentation.

(Note: Earlier versions of the manual suggested inserting the SpeedPac into slot suggested inserting the SpeedPac into slot sold. Be, the slot closes to the microprosis sockets. The newest manual states—rectly—that such an installation may present problems. If you currently own a posedPac 268 and it is generated with such as the summer of the summer of

USER-TRANSPARENT CACHING The SpeedPac 286 does not come with its own RAM except for the 8K bytes it uses for eaching. To get around the need to access information off the system's standard 8-bit bus, the SpeedPac 286 uses a usertransparent caching system. Upon execu-

ing a program, the card copies blocks of code and data from the PC's name memory into an area on its 16-bit bus. This enables the card to access works trather than bytes. It doesn't speed up screen operations much and shows very little improvement for a test with a loop greater than the RK cache, but otherwise it improves speeds about two to three times those of a standard PC or PC-XT.

Another advantage of the caching approach versus the on-board 16-bit RAM approach is that you get to keep the memory already installed in your system. Some of the boards that come with 16-bit RAM require you to disable all 8-bit memory above 256K bytes, and even after that they cither access the remaining 8-bit memory as bytes or resort to caching.

SOFTWARE INCOMPATIBILITY While caching increases the speed of many

write caching increases the speece of many operations, it can have the reverse effect with programs that tend to jump around to areas that are not cached. A cated system also raises the possibility of some software incompatibility. Victor circumvents these problems by suggesting that you disable the caching when running such programs. This causes the performance of the card to crawl alone at the PC's normal small's

Disabling caching is not as easy as it sounds. You must first shut down the system, then remove the cover, and finally either pull the card out or reach gingerly into the unit so as to reach the jumpers. PC Technologies really should have permitted a software switch for eaching

The newest version of the SpeedPac



Victor Technologies Inc.
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Requires: IBM PC or XT, a half-length slot.
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595.00 you want to be sure your choice is the very best.
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nnest example of the engineering art.
There is no question we have met our every objective by developing and manufacturing the BREAKTHKU 286 cart. This is the best designed and most functional speed up card available today. We guarantee it.
HERE IS WHAT MAKES IT SO SPECIAL.

First, it installs so easily, It is a half slot card, only five inches in length. You don't even have to give up a full slot. what's more, unlike competing products it works in the Compaq and most clones. The instructions are so simple we considered showing a picture of a child putting it in. Easy considered showing a picture or a chial putting it in. Lasy diagrams show how you just place the card in an open slot, diagrams show how you law place the card in an open slot, and the show th

is faster than the one found in the AT. A 16K cache m provides zero-wait-access to the most recently used code and data. In benchmark tests the card accelerated softwar programs—both custom and off-the-shelf anywhere from 200% to as much as 700%. Wow!

Third, you have full compatibility. All existing sys RAM, hardware, and peripheral cards can be used withou software modification. It operates with LAN and mainfra-communication products and conforms to the Lotus/Intel-Microsoft Expanded Memory Specification (EMS). Softwa compatibility is virtually universal.

Fourth, it is the best there is. There are several other boards on the market. Some are priced about the same as BREAKTHRU 286 and some are cheaper. We at PCSG h compared them all, but there simply was no comparison. What we discovered is that many cards being sold offer or a marginal speed up in spite of their claims. We found sor to be merely versions of the obsolete 8088 or 8086, and other to be just poorly engineered. The 8MHz BREAKTHRU 2 unequivocally the best executed and most completely reli-

PCSG has since early 1983 dominated the lap portable market with ROM software such a Lucid spreadsheet and Write ROM that reviewers rated as excellent. We were pro to successfully enter the IBM PC market last year with dis access speedup software. Now we are so pleased with the BREAKTHRU speedup card. We use them on our own F to make them faster than AT's. We are really excited about

this product.

PCSG makes the unabashed statement that the BREAKT 286 card represents more advanced technology than boar by Orchid, Quadram, Victor, Mountain, P.C. Technologie Phoenix... we could go on.

But an ad cart let you experience it for yourself. That's we sell the BREAKTHRU 286 on a 60 day trial. If you are completely satisfied return it within 60 days for a full refu It is priced at \$935. Call today with your MasterCard, Visa American Express or COD instructions and we will ship y card the very next day. CIRCLE 489 ON READER SERVICE C













ACCELERATOR BOARDS

286 ran flawlessly when tested with both CGA and EGA cands. Earlier versions displayed serious compatibility problems with IBM's EGA cand because of a conflict with the EGA internal registers when writing dots on even-byte addresses. (See the review of PC Technologies' 286 Express Card for a full description of the problem.) According to a synkeperson straight sway. For useful in be old; and, and the company sends you the upgraded EGA committel bound.

The SpeedPac 286 can accommodate either a 5-MHz or an 8-MHz 80287 math coprocessor. Installation requires inserting a socket plug into the 8087 socket, setting a jumper to select the proper clock speed, and setting your system board's coprocessor DIP switch to off. Following the manual's directions will present you with a problem if you have an Intel Above Board installed. It seems that the Above Board system manager does not like the DIP switch set to off, and if it is, the Above Board will report an error and refuse to load. Leaving the switch set to on-as the Above Board wants it-presents no problems. Using an 8-MHz 80287 increases floating-point calculations performed with the math coprocessor by the speed of about 20 percent over the 5-MHz version.

If you are looking to increase your processing speed significantly, do not want to make that many changes to the present configuration of your system, and do not think you will ever need to disable your cache, Victor Technologies SpeedPac 286 is a good investment.

-Vincent Puglia

TinyTurbo 286

The TinyTurbo 286, from Orchid Technology, is one of those rare pieces of equipment that does what it's supposed to with no fuss, no muss, and remarkably little bother. Its purpose, of course, is to speed up your PC or XT, and it does so in a way that isn't likely to interfere with anything else in your system.

The TinyTurbo 286 is built around the 80286. The chip is rated at 8 MHz and runs at a little over 7 MHz, or somewhat faster than the AT. There is also room for an optional 80287 on the board. A jumper next-

to the 80287 socket lets you set the board for either the 5-MHz version of the coprocessor or the more expensive 8-MHz version. PC Magazine Labs used the 8-MHz version for its tests.

The TinyTurbo board is half-card size and designed in fit in the sto closes to the 8088 on the system board. Installation-entalls removing the 8008 from its socket and plugging it into a small pingging it into a small pingging to into a small pinggyback board on the TinyTurbo. A 3-inch calber uns from the pinggyback board to the 8088 socket. Once you have gotten the solds socked. Once you have gotten the solds socked. Once you give the will sold so with the 100 size of the

AN ODD TWIST The only problem I had with this board was during installation. Pulling the 8088 from the system board is not a trivial task, even with the chip-puller that comes with the board. And noce you get the 8088 out, straighten the pins, and plug it into the piggyback board, you still have to plug the connector from the 3-inch cable into the 8088 oscket on the system board.

The piggyback board on the TinyTurbo is offset from the socket on the mother-board by about half an inch. If you put the board in first and then try to plug in the called a supersection in the manual, you'll find that the offset puts a strain on the ribbon cable, making it difficult to line up the pins with the socket. It works better to plug the connector in first, then put the board into the slot. But because of the offset, there is no way to avoid a twist in the cable.

This isn't really a problem, except that the manual states that the cable should not have a twist in it. After staring at the cable for a few minutes, I called Orchid to find out what was wrong. It was the manual.

JUST WHAT YOU NEED TO KNOW Aside from this one inaccuracy, the manual fares well. A scant 12 pages long, it covers everything you'll need to know for installing and using the board. What's more, it's written in clear language and includes a useful fillustration and professional design layout. The manual is weak on explanation and technical information, but that comes under the category of things you might like to know, not things you have to know.

The manual claims, "Once Tiny-Turbo is installed, your system will work just the way it did before, only faster." That's just a shade off the absolute truth.

For most programs, you can set the switch on the board to turbo mode and zip along at high speed. On most of the PC Labs tests, the board clocked in at two to three times the speed of a standard PC. The difference is enough to be obtained in the most casual use—asking for a directory, for example, or watching 1-23 reactly along a spread-sheet.

There are some programs, mostly games, where the extra speed doesn't help, in those cases you simply flick the switch to go back to normal PC-XT speed using the 8088. In this PC mode, your system behaves just as if the Tiny-Turbo 286 weren't there. You can even use an 8087 on the system board, if you have one. The 3-inch distance between 8088 and 8087 made no difference in the PC Labs tests.

The one drawback to changing speed is that it also reboots the system. This means you can't change speed midstream, but it also gives you a hardware reset feature for those times when Ctrl-Alt-Del docsn't work.

CACHE MEMORY ON BOARD One warning: also on the board is 8K of RAM for cache memory, and much of the speed of the TinyTurbo 286 comes from this cache technique. The board includes a jumper for enabling or disabling the cache. I tested it both ways and found



■ ACCELERATOR BOARDS

that with the cache disabled, the speeds were significantly slower—in many cases approaching the speed for a standard PC. When the TinyTurbo 286 board accesses either system board or expansion board memory, it inserts five wait states to stretch out the read or write cycle and accommodate slow memory thins. When accessing memory from the cache, however, it uses 16-bit reads with no wait states.

According to the manual, some "less compatible" computers may need the cache feature disabled. In those cases, the TinyTurbo is not worth the price. But with the PC or XT there is no reason to disable the cache, and with the cache this board looks good indeed. I'm not about to trade my AT for a TinyTurbo-quipped PC. But would I put a TinyTurbo in my PC if that were my works machine? You betcha.—M. David Stone

286 TurboCache

When we were sorting through accelerator boards as they arrived at the PC Magazine Labs, we couldn't help noticing the similarly between MicroWay's 286 Turbo-Cache and Orchál Technology's Tiny-Turbo 286. The board were the exact same size and appeared to have the same components in the same place. The only obvious difference between them that we could spot was that one board said Orchál, while the to other had a label that said

FACT FILE 286 TurboCache MicroWay Inc. P.O. Box 79 Kingston, MA 02364 (617) 746-7341 List Price: Without 80287, \$595; optional 5-MHz 80287-3, \$179; optional 8-MHz 80287-8, \$295 tres: PC or PC-XT In Short: MicroWay's 286 TurboCache is the same board as Orchid's TinyTurbo 286. but MicroWay includes some additional technical information and utility programs that don't come with Orchid's bon CIRCLE 882 ON READER SERVICE CARD

MicroWay 286 TurboCache.

A defly applied fingernail proved that the MicroWay label was simply pasted over Orchid's board, and calls to MicroWay and Orchid confirmed that the boards themselves were identical. So why does MicroWay's version sell for \$100 less than Orchid's version?

A FEW DIFFERENCES The answer seems to be a matter of cutting corners, with the biggest difference being that MicroWay offers a 1-year warranty while Orchid offers 2 years.

Another noteworthy difference shows up in the manulas. It's obvious that so of them is a rewritten version of the other. But, as noted elsewhere, Orchid's manual offers a useful illustration and a well-designed layout. MicroWay's manual skips the illustration, leaving you to find impress and sockets on your own. And its layout makes the text more difficult to makes the text more difficult to always and the contains additional technical information (though some of it is wrong and is being rewritten).

BUNDLED PROGRAMS MicroWay also bundles several utility programs with the board, including a print buffer, a RAMdisk, an 80287 test program, and a hard disk cache (not the same thing as the Kr memory cache). And where Orchid's manual tells you to test the 80287 on your board by running a program that uses it, MicroWay's manual just tells you to run the 80287 test program.

The overall effect is that MicroWay's version of this board is more of a backer's peakage than Orthid's version. If you feel comfortable with that, then the \$100 as the state of the state

TurboEGA

Orchid Technology describes the TurboEGA as "the world's fastest enhanced graphics adapter." When you first learn what this board is all about, the statement seems a little deceptive. On closer look, however, it turns out Orchid is absolutely

correct, but not in the way that you might think.

Above all, the TurboEGA is a clever and innovative marketing idea. On one board Orchid combines an enhanced regularies adapter and an accelerator for a PC or X1. The accelerator part of the Turber of the Turber of the Turber of the Section 1992. The accelerator part of the Turber of the Turber of the Section 1992. The section 1992 of the Section 1992 of the Turber of the Section 1992 of the Section 1992

Like the TinyTurko 286, the installation and use of the TurkoEc/Ls is fairly simple. You remove your 8088 and plug in into the TurkoEc/LA. You run a cable from the board to the 8088 socket. A set of jumpers tells the TurkoEc/A how much memory to cache. A toggle in the back witches between 8088 mode and turbo mode. Switching between modes causes a reboot.

GRAPHICS DISPLAY The EGA part of the TurboEGA is a standard configuration based on the ubiquitous Chips and Technologies EGA CHIPSet. It has all the trappings and features found on most other EGA boards (see "Achieving the Standard: 12 EGA Boards," PC Magazine, Volume S Number 14).

With the turbo mode switched off, EGA graphics are no faster or slower than on IBM's EGA or on any other EGA built around the Chips and Technologies EGA

FILE



TurboEGA Orchid Technology Inc. 47790 Westinghouse Dr. Fremont, CA 94539 (415) 490-8586

List Price: 3945; for optional 80287, \$375 Requires: IBM PC, XT, or computible. In Short: By giving you an acclemator and an enhanced graphics adapter combined on one board, the TurboEGA saves you a slot and some money. This is an ideal board for people who are looking for both features. CRICE 884 ORRAPHER SINGEC. CHIPSet. With the turbo mode switched on, the graphics are no faster or slower than on IBM's EGA board with Orchid's TinyTurbo 286 installed, which lets your graphics run about twice as fast.

TEXT DISPLAY. For the display of text brough the BIOS, however, the Turbo EGA's combination of the accelerator and EGA on one board provides a distinct ad-EGA on one board provides a distinct ad-EGA one that the EGA one of the EGA

used for graphics. The TurboEGA BIOS also proves that you can still get some "turbo" power from tight programming without any hardware speedups. Generally, DOS uses the BIOS Teletype routine for screen output. Since the speed of this Teletype routine determines, for instance, how fast a DIR listing displays to the screen, it's something you'll experience every time you use your PC. It just so happens that the BIOS Teletype routine in the TurboEGA has been highly optimized for speed. For instance, the first thing the Interrupt 10h BIOS routine does is check to see if it's being asked to do a Teletype call.

This software optimization is significant. Even in non-turbo mode, the BIOS Teletype routines are twice as fast as IBM's EGA BIOS and faster than any of the EGA boards reviewed in "Achieving the Standard: 12 EGA Boards." (Howevp, because of this optimization, the Teletype routines will disable screen-recall programs.)

STILL SOME BUGS The EGA BIOS in the board I tested (Version 1.2) still needs some work, but the bugs are not severe and are typical of EGA boards in early stages of marketing. The Write String logic is not consistent with IBM's, and the automatic foot and only on a mode reset causes the EGA to crash.

An included disk contains software for CGA or Hercules emulation using the Non-Maskable Interrupt (NMI) technique.
I have not been happy with this form of menulation on other boards, and I'm still not happy with it. In fact, it results in one small hight to the TurboEGA. Because the emulation software and 8087 Exception interrupt both use the NMI, the manual recommends that the "coprocessor interrupt both use the NMI, the manual recommends that the "coprocessor installed" switch on the system board be turned on, even if an 8087 is installed. This disables the 8087 Exception interrupt in

non-turbo mode. Without the CGA and Hercules emulation software, I found I could leave the system board 8087 worked fine in non-turbo mode. So, If you throw away the emulation software, you'll be able to get full functionality out of the system board 8087 while in 8088 mode and out of the 80287 on the TurboEGA board while in turbo mode. Terrific.

A HOT COMBINATION So what is the TurboEGA exactly? I've decided that it's multifunction board. But whereas most multifunction boards combine relative mundane items such as memory, parallel and serial ports, and a clock, the TurboEGA combines two hot (but still relatively uncommon) PC enhancements. This is a daring and interesting twist on the multifunction concept, and Orchid has carried it off ver well.

The TurboEGA may be "the world's fastest EGA," but it's also "the world's prettiest accelerator." I like this board—I like it a lot.—Charles Petzold

SuperSprint

Quadram Corp.'s newest accelerator card, the SuperSprint, is somewhat similar to the Quadsprint (reviewed in this issue) in that it offers reliability, ease of use, and a conservative speed increase at a reasonable price. It differs from the Quadsprint in that its design includes a larger cache area and a socket for an optional 8087.

The SuperSprint's 10-MHz 8086 comes on a full-length card that draws 7½ watts of power. While the beta test board 1 reviewed included jumpers, Quadram has stated that they will be replaced with moremanageable DIP switches (a change already reflected in the documentation).

Rather than being limited to the 4K bytes of direct-mapped cache found on the Quadsprint, the SuperSprint has two types of caching: 32K bytes for direct page and 6K butes for impres cooking.

96k bytes for image caching, Installing the SuperSprint is about as complicated as whistling Dixie; you may more want to do it professionally, but you will be able to do it whenever called upon. Even novices should be able to pull their 8088 chip, slap the SuperSprint into amproy slot, and connect the cable within 5 minutes of taking the cover off their PC or TXT. If you are neversion should be able to pull their SWR. If you are neversion should be able to pull their should be able to show that with the SWR person with the should be able to show that with the SWR person with the should be able to cache whom termoving the card.

When you boot your system, the SuperSprint copies the first 96K bytes of memory into its image cache. This is the area in memory that contains DOS, interrupts, and the beginning code of many applications. Another 32K bytes of on-board 16-bit direct page caching enables the SuperSprint to access some of the other data.

SOFTWARE-SWITCHING THE CACHE
Perhaps the nices feature of this value
(and one that other manufacturers would
do well to include in their companie
boards) is its ability to enable or disable theat,
eache with a one-line BASIC stable theat.
(If you have never used BASIC, don't
worry, because the documentation detailed instructions, you cannot appreciate such a feature until you install a new
program or card, only to discover some incompatibility problem. With a software



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■ ACCELERATOR BOARDS

switch, you simply disable the cache, determine whether the accelerator card is at fault, and proceed from there. Without the software switch, you need to disassemble your unit, remove the card, change the jumper setting, reconnect your card, and then proceed. I love switches that do not require shutting down the system.

The SuperSprint is completely EGA compatible. Like almost everything else about this board, its use of the enhanced graphics adapter is transparent. Unlike the Quadsprint, the SuperSprint displayed virtually no snow when used with a color/ graphics card.

THE ONE EXCEPTION The only PC Labs test that the SuperSpirit failed had to do with the 8087. Like some other board in this roundup, Quadram's board failed to mabb the Exception interrupt. As explained in this article's introduction, this may present problems when rounting promay present problems when rounting proposed problems when rounting proposed to the proposed problems of the TRAN, and Pascal. Aside from that, the floating-point calculation with the 5087 muth exprocessor showed an increase of almost 245 times that of a standard x1.

We also received a version of Micro-Cache with the SuperSprint. This noncopy-protected software includes utilities for disk caching, print spooling, and RAMdisks, It supports EMS, EEMS, and extended memory schemes. The software is easy to use and offers enough flexibility and power to make it quite useful.

COMPETENT DOCUMENTATION The documentation we received with the board may have been a preliminary version, but it was at least up to par with Quadram's other manuals. Besides giving installation and usage instructions and specifications, it included a detailed section on enabling and disabiling the eache from DOS and WordStar, plus another section that described the actual caching

implementation. Quadram's SuperSprint may not scream down the silicon corridors of your PC's memory, but it does sprint across them at a respectable clip. If you need speed and reliability but do not want to push your machine to the limits, the SuperSprint is probably what you are looking for, "Wincent Puglia."

■ Number

Smasher/ECM

MicroWay's Number Smasher/ECM connains a 10-MHz 8086 that runs at 9.54 MHz, precisely double the speed of the 8088 in your IBM PC or XT. The board can include up to I megabyte of memory, which replaces the memory on your system and expansion boards. Processor speed doubles because of the faster clock and sometimes almost triples owing to the 16-bit accesses of the 8086. MicroWay

■ ECM is MicroWay's approach to expanding

8086. That will help even more.

To install the Number Smasher, you must remove your 8088 and 8087 and any expansion memory that would conflict with memory on the accelerator board. A cable from the Number Smasher connects to the 8088 socket.

EASY MODE SWITCHING. The Number Smasher's 8066 can run in either fast mode (9.54 MHz with 16-bit accesses) ors solw mode (4.77 MHz with 5-bit accesses). You can switch between modes with our rebosting by a variety of methods: a running the two programs provided on the control of the control of the control state of the control of the control of the keyboard after you've installed the memoryresident PS. COM. In either slow or instruction of the control of the mode, the processor uses an optional mode, the processor uses an optional control of the mode. The control of the control

Number Smasher software also includes a diagnostics program, 8087 test programs, disk caching, a RAMdisk, and print spooler utilities.

The slow mode emulates (but does not exactly duplicate) an 8088 running at 4.77 MHz. It will actually run somewhat slower (sometimes up to 20 percent slower) than a

normal machine. This results from the 8086 16-bit accesses. External hardware on the board translates each word access to 2-byte accesses, so the Number Smasher board must sometimes make one more

byte-instruction fetch than is necessary. The fast mode has no wait states in the 16-bit memory accessed except for memory writes that occur in the 256K bytes of system board memory (or 64K for old PCs). Five wait states are inserted when the board also writes to system board memory, so the DMA controller continues to work.

THE ECM MODULE At the time of this testing, MicroWay had just developed a new "improved" Number Smasher that Memory (ECM) module. The most charitable thing I can say is that the ECM module is in the early stages of development and may be improved in the future. ECM is MicroWay's approach to expanding DOS memory beyond the 640K-byte limit all the way up to 1,016K.

Use of ECM requires a device driver called MEGADOS to be listed in your CONFIG.SYS file and a program called MEGADH when you execute MEMSET with a parameter indicating the desired memory size of DOS, your machine re-boots with that new size. You may also instruct MEMSET to copy the contents of the ROM BIOS and ROM BASIC into the Number Smasher memory. Doing so will significantly speed up BIOS operations



Number Smasher/ECM MicroWay Inc. P.O. Box 79 Kingston, MA 02364

(617) 746-7341 List Price: \$699 (512K); \$799 (1 Mbyte); \$250 for optional 8-MHz 8087; \$295 for optional 12-MHz 8087

Requires: IBM PC or XT In Short: The Number Smasher/ECM is very fast even though it relies on an 8086 rather than an 80286. However, a new Extended

er than an 80286. However, a new Extended Conventional Memory module that comes with the board is not yet bug-free and perhaps will never be. ORLE 437 ON PEADER SERVICE CARD

Five Tips On Buying A Personal Computer

Buying by mail is one of the best ways there is to purchase computer aquipment. It's fast, convenient and cost efficient. But with those benefits comes e risk . . . many of those inexpansiva PC clones can turn into expensive heedachas after arriv-

ing in the mail. Before you ordar PC acuipment from anyone through an ad, make sure it passes the following test. Taking a minute now could save you e lot of money . . . and e lot of eggrevation.

1. Does the product come complete? Many mail-order outfits leeve out mo

itors, display cards, disk drive controllers and other essentiels in an effort to keep the edvertised price low. By the time you edd in the cost of these components, you may not be getting such a "harsain" after all.

2. Is the machine fully tested?

Any computer is only as relieble as its components, so make sure it has passed a rigorous Quality Control tast.



Don't be bashful; call the company end ask if the machine is built primarily with domestic herdware or inferior "offshore" parts. While you're at it. esk for reprints of any product reviews from respected publications like this one (if they can't provide any, don't take e chance-no matter how low the advertised price is).

- Through The 3. How compatible is the BIOS?

 Everyone claims some degree of "compatibility," yet frequently these same mechines won't run some popular software packagas. If a mail-order outfit can't tell you what BIOS their machines use, steer clear (The AMI BIOS is generally considered the most competible).
 - 4. Does the machine meet FCC specs? Many price-cutting PCs don't meet FCC "Class B" home-use guidelines. That means they could interfere with your talevision, stereo and other eppliences. Watch out for disclaimers in the ad, or PCs reted to less demanding "Class A commerciel" FCC standards.
 - What is the company's reputation? Sometimes you cen tell a "fly-bynight" outfit just by looking at its hestily-prepared, slipshod ed. But evan if their ed looks slick, keep up on the product reviews in magazines like this one. Or better yet, call the editors directly and ask them.

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CIRCLE 373 ON READER SERVICE CARD

(such as screen output) and interpreter BA-SIC programs.

However, since ECM allows for large DOS sizes by switching around the way it addresses banks of memory, it has many of the problems I encountered with All Computers' All Card (for a review, see "More Options for Enlarging the Dimensions of Memory," PC Magazine, Volume 5 Number 11), which attempts to do something similar. Once you go beyond 704K bytes, you have to start doing something with programs that write directly to the screen. These programs include virtually all word processors, spreadsheets, popups, and any program that uses graphics. MicroWay's solution (like All Computers') is to patch these programs. The patch requires additional code to flip the display in and out of the memory space. MicroWay makes available some patches to popular programs (such as 1-2-3 and WordStar), but I did not see these.

OTHER PROBLEMS First, ECM is not compatible with EGA graphics in the enhanced (350-scan-line) mode. You cannot expand DOS beyond 640K bytes if you use these modes. Second, although I followed the manual's instructions in setting the Intel Above Board/PC to segment E000h and running MEMSET to avoid that segment, upon reboot the Expanded Memory Manager could not find the memory on the Above Board. Third, when I set a big DOS that encompassed segment B000h (where the screen normally resides) and loaded a bunch of dummy resident programs that boosted me up to that segment. I found that a program would load in both the ECM RAM and onto my screen (right before it crashed).

The old Number S masher without ECM was a nice, clean, relatively straightforward accelerator board that performed very well. The new model with ECM tries to do more than just accelerate and does not yet do it well. Although MicroWay says it will continually make enhancements and improvements for the part ECM. I fear the company may well be in an engineering ouaspirite with this board.

Fortunately, you can ignore the ECM module entirely and still have a very fast, very reliable, and reasonably priced accelerator.—Charles Petzold

Turbo Accel-286

Earth Computers' Turbo Accel-286 fulllength card comes with 64K bytes of 16th RAM and a toggle for swinking between 8088 and 80286 modes. The card ado accommodates an optional 80287 math coprocessor. Jumpers select the of memory to be accessed on the motherboard. While the Turbo Accel-286 shows some nice speed increases, its insulin, a poor manual, and design problems seriously hammer its functionality.

Installing Earth Computers' Turbo Accel-286 on an XI requires tremendous patience—more than you may be prepared to expend. While the process is similar to that \$888 from the motherboard, plug it into \$888 from the motherboard, plug it into the Earth card, set the memory switches, and connect the cable to the enpty 8088. socket—16-bit speatness in consumption of particular to the processing the contraction of a full-length card and the placement room for connecting the relatively short and extremely rigid cable.

TROUBLESOME INSTALLATION It took close to 15 minutes to plug the cable into the empty 8088 socket. Then, when I moved the system a few inches on the desktop, the cable slipped out of the socket and had to be reinserted. Installation on an IBM PC should be easier. (Earth Computers claims a longer cable is available, but it didn't send me one when asked. This apment tack of concern from the comeany

was manifested in other areas as well.)
A toggle in the back of the card allows
you to switch between 8026s and 808s.
modes. In effect, the toggling avoids compatibility problems by letting you run progams in the slower mode. The documentation notes that you should use the 808s.
mode when performing such operations as
a DISKCOPY and other timer-dependent
programs. Since this involves switching
between processors, toggling between
modes requires rebooting the system.

If you have less than 256K bytes of RAM on the motherboard, you need to set the memory configuration jumpers before you can squeeze the Earth card into an empty slot. Then you must disable all memory on any multifunction card that fills your system to the 640K DOS limit. In other words, if you want the optimum speed without conflicts in memory addressing and you already have a 640K system, you pull as many chips as you can so that the 80286 is addressing words rather than bytes. Presumably, the people at Earth Computers believe that you can afford to use the old 8-bit RAM chins as pushpins on your bulletin board. A far more elegant solution would have been to allow the 8-bit memory to be used as a cache or RAMdisk. This disabling refers only to memory below 640K; expanded memory (EMS) such as that found on the Intel Above Board is compatible with the Turbo Accel-286.

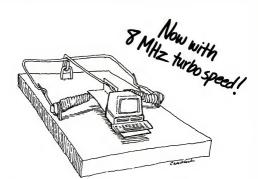
AN EGA FIX At the end of the review process, Earth Computers sent a disk with a program that copied the ROM BIOS into 16-bit RAM memory on the board. This utility lets you run BASIC programs in the 286 mode. Two other programs on the disk were an EGA fix and a fix for 80287 operation. Neither fix is what you would expect after having paid \$995 for the board.

If you boot the system in turbo mode when using an EGA card, the system asks you to hit FI to resume. Once you do so and run Earth's EGA fix, the system comes up in 40-column mode and you meed to execute a MODE CO80 command. While the entire process—except for hitting FI—can be placed in AU-TOEXEC.BAT, the solution is less than elegant and borders on the absurd. Even



software fixes.

ORCLE 658 ON READER SERVICE



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■ ACCELERATOR BOARDS

when running on a CGA, the board is far from trouble-free, displaying approximately 3 inches of snow on the left side of the screen.

While the Turbo Accel-286 can accommodate either a 5 or an 8-MTR 80287 math coprocessor, it does so with great difficulty. To begin with, the pinhotes in the socket are so small that the installation of the chip will invariably bend or break a few pins. Once you or your dealer manages so get the 80287 plugged into the socket, you will find that programs will be unable to use it.

Programs that support a math coprocessor will be able to detect that an 80287 is

Installing Earth Computers' Turbo Accel-286
on an XT requires
tremendous patience—
more than you may
be prepared to expend.

installed (using the standard routine recommended by Intel), but they will hang when they actually try to use the 80257 for acculations. It first out several different 8-MHz 80257 mush coprocessor chips in the Turbo Accel-266, and they all experienced the same problem in both the 5- and 8-MHz 80257 is not properly connected to the 80257 is not properly connected to the S0257 is sufficient to the S0257 in the S0257 at all.

It was only after I advised Earth Computers of the problem that the company sent the disk with the fixes. However, instead of addressing the problem, the fix simply reset the coprocessor DIP switch on the motherboard. But since most programs do not use this as a presence-test for the math coprocessor, it didn't help at all. Earlier Turbo Accel-286 boards came

with I megabyte of RAM. However, because they lacked any software and because of certain design problems, such as conflicts with memory addressing (programs never knew whether they were running in 8-bit or 16-bit memory). EdoComputers came out with the 6-bit Schot computers came out with the 6-bit Schot on the company's part, coupled with the implementation of its new board, has since caused me to worry about the quality of any of its boards.—Vincent Puglis

286 Speed Pak

Classic Technology's 286 Speed Pak ranks as one of the fastest accelerator boards tested here. It mas as 3-M1z 80286 and includes 1 megabyte of on-80286 and includes 1 megabyte of on-8-M1tr 20237, In fast mode, the board transfers the contents of your ROM BIOS into memory on the board and accesses both the transferred BIOS and conventional user memory with 16-bit worw with 16-bit worw.

The short (30-page) manual covers installation of the board. This involves transferring your 8088 to the 286 Speed Pak and attaching a cable between the board and an empty socket. You must also remove an 8087 if you have one and remove or disable all memory on expansion boards except expanded memory conforming to the Lotus/Intel/Microsoft expanded memory specification. The manual also recommends removing all but the first 64K bytes of memory from the XT system board. It's not necessary, but it reduces power consumption. You can make your XT think it has only 64K on the system board by setting the DIP switches appropriately.

MIRRORED MEMORY Although the 286 Speed Pak uses 640K bytes of onboard memory, your existing system board memory is not entirely neglected. To prevent running atoul of the DMA controller for disk accesses, it must also write to remaining system board memory. This mirrored system board memory is 256K on 256K PC but only 64K on a 64K PC or

A resident program, called Speedup, included with the 286 Speed Pak fills up what's left of this lower 64K bytes of XT memory, and so your applications programs run in memory that is not mirrored. Software with the 286 Speed Pak includes

PC-XT

a RAMdisk and print spooler. The RAMdisk software is an old-afshioned resident program that requires setting your system board DHF switches to indicate that another are CONFIG. SYS driver programs.) Unfortunately, the RAMdisk and print spooler take up part of your 640K of conventional memory, even though the board has leftover RAM that is not used for anything.

A toggle switch on the back of the board selects between the 8-MPL 80286 and the 4-77 MHz 80286. The slow mode but your 8088 back into the socket, so to speak, and makes your system work almost as it did without the board. Your programs still have access to the 640K bytes of memory on the 286 Speed Pak, but you lose the use of a math coprocessor. Since the toesele selects between two

since the toggie selects between two processors, you can't make the switch on the fly. Doing so usually causes the PC to crash. In the best case your machine will simply reboot.

EGA compatibility is a problem. When you power up your machine in turbo mode, an EGA board will emit one long and three short beeps (a memory-check error), switch to 40-column mode, and come up thinking it has just 64K bytes of memory. (Classic Technology says this is a problem that occurs with about one out of four of IBM's EGAs, but I encountered it with two out of two. Classic also says it has a hardware improre to fix it.)



286 Speed Pak Classic Technology Inc. 2090 Concourse Dr. San Jose, CA 95131

(408) 434-9333 List Price: \$995; \$299 for optional 5-MHz 80287-3; \$499 for optional 8-MHz 80287-8; \$895 for optional 2.5-Mbyte memory module card

Regulars: IBM PC, XT, or compatible. In Short: The 286 Speed Pak is certainly fast enough, but it displayed some instability and had problems with the EGA during botoup. The bound problethy makes most sense when used with the memory modules and Classic's multitasking software (neither are reviewed here), but then you're getting into big backs. CRULE BROWNERSPROCEANS

■ ACCELERATOR BOARDS

RANDOM CRASHES I didn't encounter any compatibility problems with normal programs, but the bowd had shabit of madomly crashing—not often enough to madenly crashing—not often enough to me level of it. The board consistently crashed only when running one of the PC Magazine Labs test programs that used channel 2 of the S254 timer chip for some precise measurements of processor speed and wast states. Although some other as—port strange results, the Classic 286 Speed Pak was the only one that crashed Labs was the only one that crashed Labs.

Although I did not have the opportunity to test them, Classis Technology also sells 2.5-megabyte memory modules that plug classis are considered to the control of the 26 Speed Pak but use up a slot each. These memory modules provide each. These memory modules provide address and 16-bit data path for the 80296 accesses. Classis Technology sells a multitaking system that incorporates use of these boards with software supons.

Although Classic Technology believes that the board will be compatible with a future protected-mode DOS, the company is wisely not emphasizing that potential. 17 wait and see. Once you start adding up the cost of the memory modules (\$895 and a slot each), it starts to make much more sense to just buy an AT and be sure. — —Charkes Petzold

■ PC-elevATor

The PC-elevATor with an 80286 running at 10 MHz is the winner in any speed contest for accelerator boards. The board installed easily and, like a skyscraper lift, whizzed through most of the PC Magazine Labs tests at ear-popping speeds. Unfortunately, however, it did not quite make it through all the tests, giving our staff a ratherebumory ride.

Our trip skyward began uneventfully enough. Installation consisted of menty plugging the full-sized PC-elevATO board into an open solt and running an install program on the supplied utilities disk. The install program requests the name of a directory (which must already exist) into which it will copy the PC-elevATO command and system files otherwise, installation is automatic, and no operator intervention is required. During installation.

When PC-elevATor is running properly, it screams with performance.

PC-elevATor's main system file, UP.SYS, is copied in the root directory and its name is automatically appended to the CONFIG.5YS file. At this point, installation is basically complete, although you may elect to further modify your CONFIG.SYS and UP.SYS files in order to take advantage of PC-elevATor's moreadvanced features, such as extended and expanded memory and print spooling.

UPSTAIRS/DOWNSTAIRS Once installed, PC-elevATor is invoked by running a program called Up. Up actually performs a warm boot, passing control of the entire system to the PC-elevATor board and its 80286 processor. In theory, most users would want to add Up to their AU-TOEXEC.BAT files and then spend all their time "upstairs" in the accelerated mode. However, PC-elevATor also comes with a program called Down, which restores the PC to its original mode of operation. This allows you to run programs that may be dependent on the PC's normal clock speed without having to physically disable the elevATor hardware. The PCelevATor software also includes a program called Level, which displays the current mode of operation ("upstairs" or "downstairs"). A special feature of Level even makes it possible to add an appropriate status message to the system prompt, such as "UPC>" or "DOWN C>".

When PC-elevATor is running properly in its upstairs mode, if airly screams with performance. As expected, of course, the disk-intensive tasks in our PC Labs tests showed only marginal improvement. CPU-dependent tasks were what you'd expect from an 80286 running at 10 MHz with no wait states. The times were not quite double the speed of a 6-MHz PC AT, but they were perty close.

PC-elevATor shows off its greatest speed—and greatest peculiarities—in han-

ding the screen. Normally, programs camnot write to the color/graphics adapter until the display is in a vertical or horizontal retrace. Otherwise, snow will appear on the screen. The PC-elev-Alor buffers all screen outputs and then blitzes them out to the screen in fast bursts.

The improvement in speed for programs that use screen output is incredible: 3½ times faster than a 6-MHz PC AT in the screen output using the BIOS Teletype call and better than double the speed of a 6-MHz PC AT for our 1-2-3 macro.

But the result insofar as how the screen looks is strange. The PC-elevAT or's method of updating the screen in discontinuous spuris gives the screen a jet rijke jeeling and ruins the effect of many graphics displays, including animated screen displays. Another related graphics problem is that PC-elevAT over ull not support IBM's Ethanced Graphics Adapter, except when it is running in Color/Craphics Adapter et, was that the PC-elevAT or board except when the third problem is the problem of the pro

RELIABILITY VERSUS SPEED Our reliability problems with the PC-elev ATor began immediately after installation. Everything worked fine in the downstairs mode, but some very strange things began



PC-elevATor Applied Reasoning Corp. 765 Concord Ave. Cambridge, MA 02138

(617) 492-0700 Lat Prices: 8 MHz with 1 Mbyte of RAM, \$1,195; with 2 Mbytes of RAM, \$1,595. 10 MHz with 1 Mbyte of RAM, \$1,995; with 2 Mbytes of RAM, \$2,745; 5-MHz 80287 coprocessor, \$235; 8-MHz 80287 coprocessor,

\$425. Requires: IBM PC or compatible, one ex-

In Short: This 80286-based entry is a veritable speed demone, but it took us a while to get one that worked right. It supplies Lotus/ Intel/Microsoft expanded memory specification and AT's extended memory right on the board, but it doesn't support IBM's Enhanced Graphics Adapter.

hanced Graphics Adapter.

ORCLE 888 ON READER SERVICE CARE

"Medium" Accelerator Boards: Summary of Features

	Price	Card length	Installation	Micro- proces- sor	Clock speed (MHz)	Walt states	Mem- ory cach- ing	caching afficiancy (speed improve- ment)	Emulates normal speed	80287 option	ece? Exception Interrupt works	EGA compat- ibility	Above Board compat- ibitity
87 88 Turbo Seard	\$149	1/2 length	Cable to 8284 sucket	NEC V20	6.67, 7.4, 8.0	0	None	NA	Software	(Uses 8087 on system board)	Yes	DK	DK
Quadsprint	\$345	3½ length	Cable to 8088 socket	8086	9 54	6 to 7	4K	400%	Disables cache with jumper	Optional daughterboard	Not tested	DK	0K
286 Express Card	\$595	1/2 tength	Cable to 8088 socket	80286	7.2	5 to 6	8K	525%	Disables cache with jumper	Yes	Yes	Problem with graphics	DK
SpeedPac 286	\$595	1/2 length	Cable to 8088 socket	80286	7.2	5 to 6	8K	525%	Disables cache with jumper	Yes	Yes	DK	OK
TinyTurbo 286	\$695	½ length	Cable to 8088 socket, old 8088 on board	80286	7.16	5	8K	525%	Toggle switch	Yes	Yes	DK	DK
286 TurboCache	\$595	½ length	Cable to 8088 socket, old 8088 on board	80286	7.16	5	8K	525%	Toggle switch	Yes	Yes	DK	DK
TurboEGA	\$945	Full length	Cable to 8088 socket, old 8088 on board	80286	7.16	5	8K	525%	Toggle switch	Yes	Yes	DK	OK
SuperSprint	\$595	Full	Cable to 8888 socket	8086	10	6 to 7	128K	550%	Software	Yes	No	0K	0K

"Large" Accelerator Boards: Summary of Features

	Price	Card length	Installation	Micro- proces- sor		Wait states	Memory on board	Emulates normal speed	8087/ 88287 option	8087 Exception Interrupt works	EGA compat- ibility	Above Board compat- ibility
Number Smasher ECM	\$699	Full length	Cable to 8088 socket	8086	9 54	5 on lower 256K writes	1 Mbyte	Toggle or software	Yes	Yes	DK	DK
Turbo Accal-286	\$995	Full length	Cable to 8088 socket	80286	8	1 to 2	640K	Toggle switch	Yes, but not functional	No	Error on boot	DK
286 Speed Pak	\$995	Full length	Cable to 8088 socket, old 8088 on board	80286	8	Crashed test program	1 Mbyte	Toggle switch	Yes	Yes	Error on boot	DK
PC-elevATor	\$1,195	Full length	Software drivers	80286	10	Problem with test program	2 Mbytes	Sottware	Yes	Yes	No enhanced graphics in fast mode	Uses board EMS only in fast mode
PC Turbo-286a	\$1 195	Full	Software drivers	80286	8	3	1 Mbyte	Software	Yes	No	No enhanced	Uses board EMS

tength

-Indicates Editor's Choice

to happen as soon as we went upstains. The most frequent of these caused our tests to terminate and the PC-elevATor to fall immediately downstains, accompanied by the cryptic error message "unexpected interrupt #303." Another intermittent condition inappropriately caused the operating system to return a "not enough memory" message to any nonresident command, forcing us to rebusy.

These and a variety of similar problems suggested to us that our particular board or its software might be corrupted—a suspicion shared by the staff at Applied Reasoning. So, 2 days and one replacement board later, PC Labs rean all the tests, as well as ■ PC-elevATor installed easily and, like a skyscraper lift, whizzed through most of the PC Magazine Labs tests at ear-popping speeds. the manufacturer's diagnostics. We were glad to discover that most of the intermittent problems had disappeared, but the new board still had problems running some of the PC Labs benchmark tests. During the memory-access benchmark test, for example, the system hung completely when expanded memory was addressed. And during the 1-2-3 spreadsheet benchmark test, our old nemesis, "unexpected interrupt #303," reappeared, once again throwing us out of the program and back downstairs. It was a very small comfort to know that these errors could now be generated more predictably. A third board corrected the 1-2-3 prob-

graphics in only in fast mode

Princeton. The



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Full EGA and CGA support. Princeton EGA monitors bring you 64 brilliant colors and bright sharp images in enhanced graphics mode, with 640 x 350 resolution. Your EGA software never looked better. Plus our HX-12E and HX-9E automatically switch from EGA to CGA mode,

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Easy Viewing and Ergonomic Design. Princeton monitors are designed for easy use, too. You get easy viewing with the HX-12E's black matrix tube and etched

nonglare screen. The lines are crisp, the characters sharp, and the colors even, so you're more productive. Controls are located on the front, where you can reach them.

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PRINCETON'

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lem. A properly functioning PC-elevATor can run 1-2-3, but it's clear that Applied Reasoning has some quality-control prob-

in the DC-elevATeris containly very fast, and we might be willing to overloak its ilmitations in the graphics area. However, we were very distanted that we could generate so many errors with our rather vanil-alfavored benchmark tests; we shudder to think what might happen to some really exotic programs, copy-protection schemes, or multitasking utilities. There are certainly reasons to consider this product, but we suggest users test it carefully on their specific applications before making a firm commitment, or the the C-elevant of the commitment of the commitment

PC Turbo-286e

Orchid Technology's PC Turbo-286e is unique. In some ways, it recalls the days of single-board S-100 computers in that it ultimately provides you with a second computer inside your XT. In other respects, it presages the advent of parallel processing by promising the ability to connect four PC Turbo-286e's in the future. Its design is so flexible that you may purchase it to turbocharge your system but end up using it as a coprocessor. As an accelerator card, the 286e offers relative ease of use. However. if you intend to make use of the board's advanced coprocessing feature, you need not only expertise but also patience, since the present incarnation of the board's system

FACT FILE

PC Turbo-286e
Orbid Telenhogy Inc.
Orbid Telenhogy Inc.
Personn, CA 490; Dr.
Personn, CA 490; Dr.
Rougieres BM FC, NT, or AT as like
Rougieres BM

software (Version 1.2) is less than perfect.
The 286e comes with an 8-MHz 80286
and I meashate of 120 nanosecond, 16-bit

and the special control was an another duckool for the special control was an another duckool for add-one, and a socker for an above the mapy, an optical language the substitution of a language the special configurable as catended or expanded memory, is available. All of this panded memory, is available. All of this continuous and the special control was allowed to drain about but do not usually see on a single board. Each PC Turbo-286e also comes with system software for running the board and swapping between modes, the

 Orchid seems intent on fixing problems.
 If it does, it will have a product that should redefine the way many of us use computers.

as well as productivity software for print spooling, creating RAMdisks, and operating eache memory and drives. For the adventurous, there is the coprocessing version of the system software.

INSTALIATION Because the PC Turbo-286c works in standern with your system's native 8088, installation can be as simple as inserting the card into an empty socket—no eable-connecting, no chippulling. Unfortunately, life is never ideal, and you will probably have to reconfigure the jumper settings. In fact, you may have to reset the jumpers more than once before you stumble upon the exact combination that is commabile with your system.

In contrast, installing the software is much easier. The menu-driven-program prompts for the board's jumper settings and I/O addresses, installs the daughter-board as expanded or extended memory, and adjusts the screen updating for your particular monitor. It then rewrites your AUTIOPENE PART and creates two new.

batch files: one for the turbo mode, the other for the host mode. It also creates a TUR-BO.SYS file (turbo's equivalent of CON-FIG SYS)

You swap from one mode to another by issuing the commands Turbo and Unturbo. If you add an argument to the Unturbo command, it is copied to the host's keyboard buffer and then executed once the swap is made. When the turbo mode is executed, the 286e copies DOS and the PC's ROM BASIC area to their respective locations in the PC Turbo-286e memory. This means you have two independently running versions of DOS-each maintaining separate keyboard buffers, working drives and directories, and pathnames. While you're in turbo mode, the system's native 8088 is relegated to I/O processing. You can configure some of the 8-bit memory to print spooling and RAMdisks, and the remaining memory is used as cache.

EXPANDED MEMORY The 286e's use of expanded memory is dependent upon the board and mode in which it is installed. While you can configure an Intel Above Board for the host, turbo mode requires Orchid's own memory management driver and daughterboard. Turbo mode can use Above Board RAMdisks, but it does not recognize the expanded memory. Daughterboard memory is accessible only in the turbo mode. As far as the host knows, any RAMdisks installed on the daughterboard do not exist. When running applications in EMS, either the Above Board or the daughterboard will be accessed, depending upon the mode you are running in.

EXTENDED MEMORY While the procedure for installing the daughterboard and RAMdisks is fairly straightforward, it is not idiot-proof. For example, you can install the daughterboard for extended memory and then create RAMdisks in both extended and expanded memory. The system checks only to see that the device drivers are present; it does not check to see whether the memory exists. Evidently, when the TURBOEMM.SYS is loaded, it uses the reserved extended memory. It does not go back to Orchid's BIOS and readjust the amount of extended memory accordingly. Copying files to both drives effectively trashes them because, essentially, the data

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is occupying the same memory. While this is a serious flaw, it is avoidable by following the instructions in the manual (and hopefully Orchid will rewrite the memory manager so that such an installation is no longer possible).

Speed improvements with a PC Turbo-Sele range from 200 to 900 percent, with most operations displaying an increase of four or five times that of the standard XT. If you want even more speed, you could replace your 808s with another accelerator card, such as Orchida's Ting Turbo 286. It will not increase the executing speed of any memory-intensive tasks, but it will cut turboun teal by guite a bit because the Ting Turbo v 286 nather than the XT's 88 is accessing the disk cache.

COMPATIBILITY PROBLEMS The 286e has two compatibility problems: it cannot recover from an 8087 Exception interrupt properly, and it is not EGA compatible. The former problem means the board may have difficulty running programs that use floating point compiled under Microsoft C. FORTRAN, and Pascal. The latter means you use it with an EGA board, but only in CGA-compatible mode. According to Orchid, the EGA's unbuffered, I/O context-sensitive addressing is inherently incompatible with the 286e's screen updating algorithms. Orchid is presently working on an EGA-compatible card that connects directly to the PC Turbo-286e bus.

COPROCESSING VERSION While Christ supplies the hardware for coprocessing, the supporting software is lacking. The coprocessing version of TURBO .COM and the demonstration programs (source and compleid) appear to be bed versions: the documentation is in READ ME files, there are only minimal concessions to a user interface, and bugs first and the supplies of the control of the con

One of the demonstration programs sets up an application on each processor and displays the output of the first mode in a window of the second. When run, the displayed output proved to be unreadable, and when I swapped to the other mode (using a predefined "hot key"), the window remained on-screen until it scrolled off. The lack of screen updating is definitely frustrating, especially if you run off-theshelf applications—such as WordSour on both processors, the homeon parties of the control of the total of the control of the control of the theory is a charge of cross-linking files when saving them to the same disk and direstory.

Of more concern, though, is a bug that occurs when you crash out of an application. On at least three occasions after a warm boot from within the program—once with EDLIN, twice with WordStar—the systems said the program may be in-

■ You can use the PC Turbo-286e if you are careful. Remember, though: speed kills.

compatible with the 80286 and then dropped back down into host mode. When I tried running them in host mode, they also refused to load. A DEBUG dump showed that text had been written into the program files. This implies that the coprocessing version has a problem closing files

when you do not exit from them properly. Equally troublesome is a tendency of extended memory RAMdisks to create bad FATs. Each time I built three RAMdisks totaling 920K in the I-megabyte extended memory area and then filled them with files, the last disk invariably collapsed. If you no CHKDSOK. The system reports you no CHKDSOK. The system reports you no CHKDSOK. The system reports and then crashes, dropping you down into host mode. According to the people at Orchid, they have located the bug and are in the process of exterminating it.

Despite the software bugs. I find the PC Turbo-286e an exciting product that warrants close observation. Orchid seems intent on fixing the problems; if it does—and adds a friendler shell to the coprocessing software—it will have a product that should redefine the way many of us use our computers. If you can't wait for a deEDITOR'S

The medium cards are generally lady-length cards and re's upon memory caching for speed. The clear winner in this caregory is Ortatid Technology shall-length Timp Turbo 286, which is easy to use and highly reliable. The 80286 runs of 1,16 MHz, and the 8K cache provides a significant improvement in speed while maintaining nearly normal bus timings. The Timp Turbo 286 also has a true non-turbo normal mode that wo can select.

mal mode that you can select. The board is also sold by MicroWay under the name 2.86 TurboCache and comes with software and technical information not available from Orchid. The TinyTurbo 286 also shows up as half of Orchid 5 TurboEGA, in which an accelerator and an Enhanced Graphics Adunter sweresitically coexist.

The large accelerator board ranks as one of the most complex pieces of hardware you can put in your PC or XT. These boards never seem to be quite finished or in final form, since their manufacturers must always scurry to fix yet another newly discovered problem.

The only reliable board in this category is MicroWay's Number Smastler ECM, but only if you pretend that the "ECM" (Expanded Conventional Memory) module that comes with the board does not exist. Aside from the repretable ECM, the Number Smastler doesn't try to bite off a bigger chunk of your computer than it has to.

bugged coprocessing version, you can use what is available if you are careful. Remember, though: speed kills.

—Vincent Puglia

M. David Stone and Vincent Puglia are frequent contributors to PC Magazine. Michael K. Guttman is a computer consultant based in Marlton, New Jersey. The three-dimensional bar graph at the far right shows the normalized results of four representative performance tests and an average for the 18 boards reviewed here. For emparison, the graph also shows results for a stock 4.77-Hz PC or XT, a PC or XT with a NEC V20 installed, a 6-MHz PC AT, and an 8-MHz PC AT

In all cases, the results are for the turbo boards running In all cases, the rebuilts are for the turbo boards running and the fastest speed we could manage. Any orthware enhancements that may have been provided with the boards (such sarprograms that translerend the constructs of the ROM BIOS to memory) wet also loaded before running the sure of memory) weter also loaded before running the sure. Boards that included a NEC V2O option were run with the V2O installed.

The accompanying table (upper-left corner) shows the raw-times for these tests. For the bar graph, the times were normalized based on a 100 percent rating for a stock PC or XT.

The NOP benchmark test is designed to measure raw clock The NUP benchmark test is designed to measure raw clock speed and menary access time while minimizing differences is microprocessors and the effect of memory caching. This test executes aimset neithing but NUP (No Operation) ma-chine code instructions in a big 128K loop, Secusion most other performance tests are small loops with complex in-structions, they are inherently based toward boards that use mory caching and the 80286 microprocessor. This test as balance things out to make the average result more cative of realistic instruction mixes.

Fishing-point cateriation

The floating-point calculation benchmark test (including logarithmic and forgocometric functions) is done on software without an 8887 math coprocessor. The benchmark test was programmed in C and compiled under the Microsoft C Com-piler, Version 3.0. This test mass significantly faster on 80286-based twitho boards because software floating-point calculations require many metipies and divides.

The 1-2-3 routine (Release 1A) creates a large worksheet, The 1-2-J routine (Rinteste IA) creates a large worksheet, moves nows and colorens around, does recalculations, and utilimately erases the worksheet. This test is partially depend-ent upon the vidoo adoptar installed in the PC. All boards were tested with a Color-Translics Adapter except for Orchid's TurboEGA, which used the Enhanced Graphics Adapter that least of the bard. is part of the board

We also measured screen display response lines for test written through the BIOS "faithper" function. COS uses the BIOS ratifies for ment land cause from the DOS commend level for instance, during a DIO commend, so it is a commonly exceutive grant of CF cas. Those bearest that caused a provision to copy the contents of the RIDME BIOS into memory on the board will not the test The SubpoSEs is a spocial case, since it uses in ESA RIDME BIOS instanded on the acceleration board and optimized for Network DIOS instanded on the acceleration board and optimized for Network DIOS instanded on the acceleration board and optimized for Network DIOS instanded on the acceleration board and optimized for Network DIOS instanded on the acceleration board and optimized for Network DIOS instanded on the acceleration board and optimized for Network DIOS instanded on the acceleration board and optimized for Network DIOS instanded on the acceleration board and optimized for Network DIOS instanded on the acceleration board and optimized for Network DIOS instanded on the acceleration board and optimized for Network DIOS instanded on the acceleration board and optimized for Network DIOS instanded on the acceleration board and optimized for Network DIOS instanded on the acceleration of the DIOS instanded on the acceleration of the DIOS instanded on the acceleration of the DIOS instanded on the DIOS instanded on

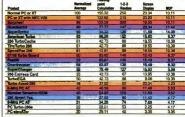
Finally, we crested a normalized average result of the four

Finish, we crease a normalized versige ressur or me nour best evenly weighted. Never right is shown formation in A separate bor graph (lever right) shown formation in suits of the same fleating-point test described above, run with an 8007 or 80287 math coprocessor on the acceleration bond. In all cases, no list bits seed the macrimum 8001/7,00287 speed the beard could be configured for Some boards could not use an 8007/80078, so threse boards are not moduled in 400 kest an 80078/80078, so threse boards are not moduled in this graph.

Benchmark Tests: Accelerator Boards

Performance Times

(All times given in seconds and decimal seconds)



Bang per Buck

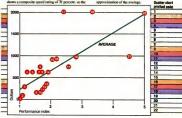
Of course, accelerator bourds cost money, but this cost may not be directly proportional to the speed improve-ment they provide. You can get an idea of the value of each accelerator board from the "Bung per Buck" scatter nict shown below

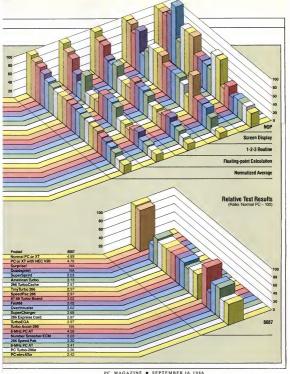
The Performance Index axis of this graph is simply the inverse of the Average Speed shown in the three dimensional bar graph. For instance, an 8-MHz PC AT shows a composite speed rating of 31 percent, so the

Performance Index is 3.23.

The Price axis is generally the base price of each accelerator board without additional memory or an 8087 option. However, since we measured the speed with a NEC V20 for no-slot boards that included it as an option, the prices for these boards include the V20. Based solely on speed improvement, the better val-

ues in accelerator boards are those furthest below and to the right of the straight-line approximation of the average.





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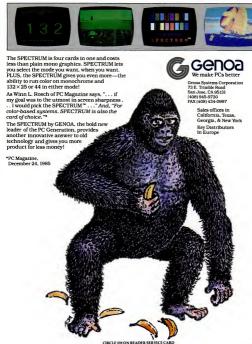
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No-Slot

ALTERNATIVE TO ACCELERATION (AND WHY IT MAKES SENSE)

hen an engineer designs a personal computer, he must design in a bit of overkill called the "engineering margin." For example, the 8088 that drives your PC is rated at 5 MHz from 0 to 75 degrees Celsius. Virtually all such CPUs

will perform just fine at 5.1 MHz or 76 degrees. It is just not practical to huild components of all possible ratings. Any chip

hild components of all possible ratings. Any chip tested at one specification will always pass at a somewhat less-exacting one. Therefore, when IBM or any other PC man-

ufacturer says it needs a widget that meets a particular specification, what it really means is one that meets or exceeds that specification. Back in 1981 when IBM first needed a CPU for its new line of personal computers, Intel did not make the 4.77-MHz 8088 that IBM specified (and it IBM)

doesn'th, but it did make a 5-MHz model that worked just fine at the slower speed. And if Intel ran out of 5-MHz models and began shipping the more-exacting 8-MHz parts instead, would IBM object? Not likely.



■ NO-SLOT BOARDS

My point is that for several reasons the engineering magnit neds to exist at almost every level in a personal computer. This margin is additive. A chip that is undernaed by 10 percent and overspecified by 10 percent results in a chip running at 20 percent under its top performance level. Thus, your PC is undoubtedly capable of more performance than you currently receive from it. This is the common premise upon which all of these cards rely.

ENTER THE PC AT Shortly after the AT was introduced, users discovered that the 6-MHz AT had originally been designed to the solection at a 8 MHz but had been set back to the slower clock speed shortly before its instonation, probably for political reasons. Some users summed—and quickly comments to the Athlet square-wave clock signal, could be safely replaced with a crystal that generates an 8-MHz square-wave. The resulting AT had a 33 percent better processor performance (86 = 1.33

= 1 + 33%). Putting an 8-MHz crystal into a new AT worked so well that the question quickly arose. What about 9 MHz? Or 10? Or 12? The mind reels at the possibilities. But ATs worked at 8 MHz because they were designed to; they were never intended to run any faster than that. And yet, hackers rapidly discovered that most ATs ran fine at 9 MHz. In fact, it wasn't until you exceeded 10 MHz that the majority of ATs could no longer keep up. Why? Because of the engineering margins built into every AT. So how could you tell how much engineering margin your machine had? You couldn't-you just kept plugging in crystals until your machine no longer booted up reliably, and then you dropped back to the previous one.

BACK TO THE PC Once users began upting faster crystals into their AT. Pc. Pc. and XT owners began to wonder if they could try the same thing. Sure, the PC was not designed to run at a higher clock speed, as the AT had been, but ATS were running at speeds far higher than designed. Couldn't PC owners just replace their crystals with faster ones? Surprisingly, they could. Because of the inherent engineering margins, some PCs and XTs can be made

to run at speeds in excess of 7.6 MHz, a 60 percent improvement. But in the PC, more relies on the square-wave clock than just the CPU.

the CPU.

One signal, called Oscillater in IBM*, diagrams, is a 3.78x-MHz signal used by diagrams, is a 3.78x-MHz signal used by the control of the control

Once users began putting faster crystals into their ATs, PC and XT owners began to wonder

if they could try the same thing.

the way, that since the monochrome card has its own clock crystal, it doesn't care what the motherboard's clock rate is.)

But what if we "splin" the motherboard to chock from the 808% s clock. A that is, conclock from the 808% s clock. A that is, continue to feed the motherboard its 4, 177 and that is, continue to feed the motherboard its 4, 177 and the 1808 processor at some higher rate? We could then have enhanced performance and still have our cotor displays and carcurate times. This is the principle that all of the small cards tested use to increase performance.

performance. To do this, all of these cards replace the stock 8088 in the PC with an 8088-2, rated at 8 MHz, or a NEC V20-8, an 8088-2 equivalent. They must also replace the 8284 clock chip, which generates the clock signals we have been discussing, with a circuit. This circuit is capable of feeding separate clock signals to the 8088 and the rest of the motherboard. One advantage to this system is that all of the original hard-

ware is retained, thus avoiding hardware incompatibilities. All of the cards tested can "downshift" into normal PC mode, dropping the 8008's clock down to the same rate as the motherboard's, without the need to reboot—a further advantage of retaining all of the PC's stock equipment. While most of these cards shift speeds with an external turbo switch, the Surprise! card changes gears via software.

All of these cards require the 8284 chip to be plugged into a socket rather than soldered directly to the motherboard. These chips are socketed in about 90 percent of all personal computers, but some older XTs have a soldered 8284. These must be taken to an electronics shop and socketed by a professional before they can accommodate most of these accelerators. The exception was one model of the Overthruster that can be installed on a soldered 8284, if you are willing to cut some of the legs off the chip. Since this required a permanent change to the PC motherboard (none of the other cards did), this model was not tested.

Stephen Davis is an electronics systems engineer in Greenville, Texas.

American Turbo

American Computer and Peripherals, the company that makes the American Turbo card, also makes a clone motherboard, known as the American XT. The American Turbo is an accelerator card originally intended for use with this motherboard. A version of the card has been adapted for the PC and XT.



American Turbo American Computer and Peripherals 2720 Crody Way Santa Ana, CA 92704 (714) 545-2004

List Price: \$135
In Short: The American Turbo has little going for it except its low price. It is poorly documented and can crash a PC during the
switch from low to high speed and back.

CREAT #87 CHREATERS STROKE CAND



From left to right: the American Turbo, the Overthruster, the Fast88, the SuperCharger, and the Surprise

Like the Overthruster card, the American Turbo inserts directly into the 8284 socket. Unfortunately, its legs are too short to allow it to seat properly into the 8284 socket on the PC. I was forced to plug in extra DIP switches in order to raise the 8284 socket sufficiently to allow the American Turbo to fit. The American Turbo to fit. The American Turbo to fit. 73-MHz

 I was forced to plug in extra DIP switches in order to raise the 8284 socket sufficiently to allow the American Turbo to fit.

high speed is available. No V20 option is offered.

UNHELPFUL MANUAL One of the weakest points of this card is its manual. Roughly half of the manual appears to have been directly copied from the Overthruster manual (about eight pages, including one diagram). Since there are some differences in the two cards, the installation procedure does not completely match the card (it does match the Overthrusser card, however!). For example, there is no explaation of how to install the four-wire ribbon cable for the reser switch. This is particularly neglectful, as the cable is not keyed to prevent if from being installed incorrectly. Further, there is no clip to hold the ribbon cable in place.

Those parts of the manual that appear not to be copied from the Overthruster manual are not always coherent or helpful. None of the cards listed a toll-free number for support, and the American Turbo manual listed no telephone number for the parent company at all.

NOT COMPLETELY CRASHIPROOF For the most part, the American Turbo did seem to work fine on my PC-1, which boosed up correctly in either normal or turbo mode, with and without an 8087-2. Unit like my experience with the other cards tested, however, I was occasionally able to reach the PC by changing from low to high speed and back. As for the unit's design, nor the American Turbo was clean Turbo was cell of the American Turbo was clean Turbo was clean to the American Turbo was clean to the content to the power switch.

Overall, except for its being the lowestpriced card in the group, there is nothing to recommend the American Turbo. The other cards are worth the extra money. —Stephen Davis

■ Overthruster

Nucleus Technology's Overthruster card is similar to the Fast88 accelerator in both form and function. PC Magazine Labs benchmark tests show identical results, and the components on the card seem to be largely the same. The Overthruster card, however, lacks the polish of the Fast88.

Rather than having a ribbino cable, the

Kanner than naving a roboon caobe, the Overthruster cand has legs on the bottom. The entire card plugs into the socket evacuated by removal of the 824 chip. Although this solves the mounting problem, the board shields the socket from view, making alignment very difficult. I found it almost an excessity to remove the A. drive in order to look undermeath the board and make sure that the board's feet were cor-



Overthruster
Nucleus Technology
17388 Santa Barbara

Fountain Valley, CA 92708 (714) 841-3336 List Price: \$195, 8088 available upon re quest: V20 processor, \$195

quest: V20 processor, \$195 In Short: The Overthruster offers only two speeds and is difficult to align in the motherboard. It performs its functions fairly well bu

speeds and is difficult to aight in the momenboard. It performs its functions fairly well but doesn't outshine the competition. CRCLE 600 ON READER SERVICE CARD. rectly placed in the socket. This problem was exacerbated by the great amount of force required to properly seat the Overthruster's oversized legs. At times the force required was so great that I wondered whether I might drive the legs of the Overthruster directly through my motherboard.

Once installed, the Overthruster daughtercard shielded many of the configuration switches on the SW2 DIP switches, which is unfortunate because it is very easy to set these switches inadvertently while installing the card.

Like the Fast88, the card's turbo speed must be adjusted to the base PC. Unlike the Fast88, which offers four, the Overhuster offers only two higher speeds, 6.1 MHz and 7.4 MHz. On my card, the documentation for these jumpers was the opposite of what it should have been: attempting to select one actually selected the other. No jumper was furnished for disabiling the reset button.

SWITCHING SPEEDS The Overthruster and always powers on in slow mode. Momentarily depressing the turbo button should switch the Overthruster into turbo mode; however, this switch worked only about 50 percot of the time. This was not really a problem, since an LED accurately indicated whether the card was in high- or low-speed mode. The reset button worked every time it was tested.

The Overthruster worked fine with an optional V20 processor, an 8087-2, and with most software. Like the Fast88, the Overthruster mass be "down-shifted" to Overthruster manual, which has no troub-schooling section, table of contents, or index, is not up to the standards of the Fast88 manual. Also, the turbo switch on the processor of the same one provided with any sort of enclosure, giving it a poor flow.

With one exception, a second, newer version of the Overthruster that we tested has all of the same problems as the older model. However, the new version allows you to insert the Overthruster into the 9088 socket. The new card is easier to install and does not conceal any of the configuration witches. Nucleus Technology also claims to have installed an improved turbo switch.—Stephen Davis

Fast88

MicroSpeed's Fast88 is a very simple card. It does not insert wait states, nor does it attempt to detect and compensate for DMA or ROM access as the SuperCharger does. It is, therefore, more dependent on the underlying hardware margins in the host machine. Because of this, the Fast88 has not two different speeds, but four.

The primary limitation on speed in the Fast88 is memory access time.

There are three different turbo modes that are jumper selectable, depending upon the capabilities of the host machine.

The primary limitation on speed in this card is memory access time. The card arrived in the 6.1-MHz mode, slow enough even for 250-nanosecond memory, which is the slowest speed you are ever likely to encounter these days. To install the card, you must first remove your 8088 from its socket and replace it with the 8088-2 (or. optionally, the V20-8) provided. You then remove the 8284 chip and insert a ribboncabled DIP switch into the socket. The cable is clearly marked, and diagrams in the book show unmistakably how the cable should be inserted. Once the card is installed, the manual recommends that you move the jumper to the higher settings of the card-either 6.7 or 7.4 MHz. If your machine will not run properly at 7.4 MHz. set the unit back to 6.7; if it still won't run, move the jumper all the way back to 6.1 MHz. One final jumper allows the user to disable the reset button, if desired.

GETTING THAT EXTRA SPEED If you really need the extra speed that you get on the 7.4-MHz setting, you can replace the RAM in your PC with faster RAM,

on the 7.4-M12. setting, you can repeace the RAM in your PC with faster RAM, RAM prices being quite reasonable these days. The problem is that the original row of chips on the motherboard is soldered in. If these are the problem memory chips, it requires an expert to remove these chips safely and replace them with sockets. An electronics shop can provide this services for less than \$100.1 anticipated protein getting my vintage PC-1, with its older 16K-bit RAM chips, to operate reliably at the highest-speed clock setting; however, to booted up without incident even at the highest setting (supersisting), the PC Magazane Labs' XT avoid not boot up at annea Labs' XT avoid not boot up at annea Labs' XT avoid not boot up at annea Labs' AT avoid not boot up at annea Labs' AT avoid not boot up to have any problems. The Fasa88 ran fine with an 8087-2 in all of its speed setting with an 8087-2 in all of its speed setting.

Once you have selected the proper speed setting, you securely mount the card on the back wall of the PC just above the 0808. A Teleo-style four-wire cable is plagged into the card, threaded through the back wall, and plagged into a small box containing the turbo switch. LED speed incare, and rest batton. This box can eidicate, and rest batton. This box can eiouffined with small rubber feet. The entire installation took me roughly 10 minutes, and the finished product had a very good overall appearance.

WELL-ORGANIZED MANULA. Some pl pages in length, the manual accompanying the Fast88 is replete with diagrams, pictures, a tempage trouble-shooting section, and a complete theory of operation all organized with both a table of contents and an index. One section advises you that a PC will not format a disk properly when in turbo mode, which I was able to verify thowever, nor of the advantages of all of the work of the picture of the content "co-wn-shift" and formatting is complet-"co-wn-shift" and formatting is completing the picture of the content of the "co-wn-shift" and formatting is completpaged. The manual complement of a qualtrustrate of the content of the content of the picture of the content of the content of the picture of the content of the picture of the content of the picture of picture



MicroSpeed
456 Penalta Blvd., #18
Fremont, CA 94536
(415) 490-1403
List Price: \$149, V20 option, \$169
In Short: A simple card with four available proceds the Faut8 is four in installation time.

speeds, the Past88 is fast in installation time as well as in name. CIRCLE 800 ON READER SERVICE CARD

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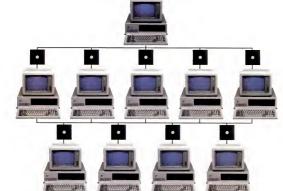
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"No-Slot" Accelerator Boards: Summary of Features

MACTINE	Price	instelletiga	Micro- processor	Clock speeds (MHz)	Weit states in test mode	Switches back to 4,77 MHz by	Leeves system board 8087 functional	8087 Exception Interrupt works	Extres
American Turbo	\$135	Plugs into 8284 socket	8888	7.37	No	External switch	Yes	Yes	Reset
Overthruster	\$195	Plugs into 8284 socket	8088 or NEC V20	6.14. 7.37	No	External switch	Yes	Yos	Reset
Fest88	\$149	Cable to 8284 socket	8088 or NEC V20	6.14, 6.67, 7.37	No	Extornal switch	Yes	Yes	Reset switch
SuperCherger	\$279	Cable to 8068 and 8284 sockets	8088 or NEC V20	9.54	0,1, or 2	External switch	Yes	Yes	Reset switch
Surprise!	\$249	Plugs into 8068 socket	NEC V20	9.54	4 to 5	Software	Not in fast mode	Not in fast mode	Nono

Indicates Editor's Choice

SuperCharger

Dynatec Systems' SuperCharger card is slightly larger and more complicated than the other small cards tested, but still nowhere near the size of even a half-length plug-in card.

The SuperCharger card runs the CPU at twice the clock speed of a normal PC (9.54 versus 4.77 MHz), but to do that it has to make certain concessions to the hardware. First, the card must insert wait states into every memory access. Second, because the DMA controller is nominally rated at 5 MHz, it reduces the clock speed whenever this chip is inactive (primarily during disk accesses). Third, it slows down whenever the ROM BIOS is being accessed, both to allow for slower ROM response time and because of possible timing loops present in

> FACT FILE

870 E. 9400 South, #103B Sandy, UT 84070 (804) 572-6867 List Price: With 8088 (10 MHz), \$279; with V20 (10 MHz), \$299; with 8087 (10 MHz),

SuperCharger

Dynatec Systems Inc

In Short: The SuperCharger is more complicated than most other boards, especially when a comes to installation, but it performs

its tasks flawlessly. E 606 LIN REA

the BIOS code.

The manual has 36 pages, almost all of which are devoted to installation-and with good reason, as this card has by far the lengthiest installation procedure of any of the small cards tested. First, you remove the CPU and the 8284 clock chin, replacing both with ribbon-cabled DIP "plugs" (the chips you attach to the end of the ribbon cable). Next, you lead the jumper around a resistor and attach three colorcoded clips to the lees of the ROM and DMA chips on the motherboard.

Access to these two chips requires that the A: drive be slid at least partway out of the front of the cabinet. Once attached, the clips must be carefully pushed down out of the way, so that the disk drive can be slid back into place, with the clips squeezed underneath. The clips provided did not seem to be quite large enough for my taste; however, not once during the test did a clip fall off. Still, I could not recommend this card for portables.

GREATER COMPLEXITY The jumpers coming from the board allow the Super-Charger card to detect when the DMA chip is enabled and when the ROM chip is being accessed. This ability to detect and change the number of wait states and clock speeds also accounts for the SuperCharger's greater complexity. It took roughly an hour to complete the

detailed installation procedure in the manual, but it was not particularly difficult. Once the wires are attached, you mount the card vertically above the CPU socket by loosening the screw that holds the first plug-in card, sliding in a specially designed bracket, and retightening the screw. The stiff new ribbon cable had a tendency to torque the card around, threatening to short it against the first plug-in

 The SuperCharger card runs the CPU at twice the clock speed of a normal PC, but to do that it has to make certain concessions to the hardware.

card. Removing the ribbon cable and bending it properly reduced this tendency a great deal.

Dynatec provided a newer version of the SuperCharger unit for V20 testing. This model was identical to the first one in appearance but, unlike the older version, had only one clip to attach in place of the older model's three (the other two clips were replaced by internal logic). Dynatec claims that by the time this article goes to press, the newer, slightly easier-to-install model will be its standard version.

SWITCHING MODES A speed switch allows you to switch the SuperCharger from normal (4.77-MHz) to turbo (9.54-MHz) mode. However, since the switch is

out the back of the PC. Although this switch location is not as convenient as that on some other boards, access to this switch is necessary only occasionally. Momenmounted on the bracket, its handle sticks | tarily depressing the switch down beyond

the "normal" position forces the machine to reset-a fact not mentioned in Dynatec's documentation.

The board comes shipped in what Dynatec calls the medium-speed mode (1.4 to 1.6 times as fast as an unimproved PC). The company recommends this mode as safe for all PCs; however, even my old PC-I with its 16K-bit chips ran fine in fast mode (1.6 to 1.8 times as fast as an unim-

proved PC). The SuperCharger has one jumper that selects the number of wait states. Although not documented, a faster mode without

 In practice, the Super-Charger card worked flawlessly with all software tried and switched from turbo to normal mode and back without problems.

memory wait states can be attained simply by removing the jumper. Dynatec does not guarantee that every PC will run in fastest (1.9 times as fast as an unimproved PC) mode but claims that Leading Edge PCs have no trouble. Since Dynatec does not support this mode, it was not tested.

WORKS PERFECTLY In practice, the SuperCharger card worked flawlessly with all software tried, switched from turbo to normal mode and back without problems, and power-on booted in either mode. As a purchasing incentive. Dynatec supplies a cache program disk at no additional cost to buyers upon submission of warranty information. This cache program has several adjustable parameters; it worked well, resulting in further system performance increases.

Overall, I give the SuperCharger high marks. More complicated than the other small cards, it performed slightly better than they did .- Stephen Davis



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than a standard AT

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the confidence to affer a

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mance. 100% campatibility.

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Surprise!

Maynard Electronics' Surprise! board is a little different from the other no-slot boards. Instead of relying upon the ability of a PC or XT to operate at a faster clock rate, Surprisel is much more conservative-ty designed. That conservative design also means that the speed improvement you'll set from it will be minimal.

The Surprise board is 3 inches square and comes with an adapter that contains the board's edge connector to the 8088 socket. The board sicks is pward from the 8088 socket. The instructions suggested placing the card into the adapter said the placing the dark to the socket. However, I found it much easier to see the dadapter first and then plug in the card. In either case, carded installation is relief to seen the adapter properly and not bend the adapter properly and not bend the adapter properly and not bend the adapter.

the starper pins.

The basic premise behind Surprise! is simple: replace the PC's own 8088 directly with a high-speed NEC V20. The V20 is set to run in two modes—fast and slow—that can be toggled by a "hot key" that's recognized by a small resident utility.

The Surprise! board software installation was also easy. The Surprise! disk comes with an install program that does most of the work. You simply tell the installation program which drive to use and what kind of video card your system has. The net result is a new or modified CON-PIG.SYS file with the added line DE-VICE=SURPRISE.SYS and a copy of SURPRISE.SYS on the root directory.



Maynard Electronics 460 E. Semoran Blvd. Casselberry, FL 32707 (305) 331-6402

List Price: \$249 Requires: IBM PC, XT, or compatible

DOS 2.0 or later.

In Short: This diminutive entry is easy to install and use. However, its conservative design made it rank the lowest of all accelerator beards in performance tests. It could not work with an 8087 math or opposessor in fast mode.



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a Junger least the manue of the constant A 77-MHz also mode gives you the same performance you'd get from replacing your 8088 with a V20. In fast mode the V20 runs twice as fast, but the Surprise! card inserts four of the walt states into every memory access. Thus, the doubling of speed is negated for memory accessor secution time. The result? Not impressive. In most speed of inferential between a 4.77-MHz. V20 and a 4.77-MHz. 8088.

Aside from this 8087 problem, Sur-



The Editor's Choice for the "noslot" cards goes to MicroSpeed's Fast88, whose manual and finish are superior to any of the other cards tested. The superior technology of Dynatec Systems' Super-Charger card is offset by its more difficult installation and higher price. prise! functioned without hitches. Since it makes direct use of the system board and doesn't attempt to access memory quickly, Surprise! plays it safe and is much less likely to have compatibility problems than

fancier boards that must bypass or defeat existing components. Playing it safe, however, just doesn't make it in the world of accelerator boards.

-Michael K. Guttman

Introducing the All-New Supercharger* II

Dynatec Systems introduces the Supercharger II, a new and improved version of the original Supercharger introduced in 1985.

The Supercharger II is a plug-in board which increases the operating

The Supercharger II is a plug-in board which increases the operating speed of your IBM PC and XT. The Supercharger II's high speed 8088 microprocessor, or optional NEC V-20 microprocessor, races at 9.54 MHz, twice the speed of your PC or XTI

FEATURES:

- New Pricing now costs \$199.00
- New Installation does not require desoldering of 8284 chip.
- New Microprocessor optional NEC V-20 available.
 No Expansion Slot Required leaves them open for memory and
 - other options.
- Compatible works with most hardware and software, including extended memory and high resolution graphics systems.
- Enhances All Operations including writing to the screen.

Performance Comparison

The table below compares the performance of the Supercharger II with other products. The PC Magazine Laboratories Bench Mark Tetts were selected because of their well-known accuracy. The numbers indicate speed relative to a "stack" IBM pc. For example, a factor of 137 in a category means the system is running 1.57 times faster than a stock pc.

	Supercharger	Surprise	fast88
Test #1: NOP execution spanning 128K	1.67	1.31	1.43
Test #2: "do nothing" 1 NOP loop	1.80	1.59	1.53
Test #3: Integer add from memory	1.85	1.53	1.56
Test #4. Integer multiply from memory	3.13	2.80	2.64
Test #5: Floating point without 8087	1.97	1.59	1.66
Test #6: Floating point with 8087	1.95*	†	1.43**
OTHER COMPARISONS:			
Norton Utilities SYSINFO index	3.2	2.8	2.6
High speed copy and format?	yes	yes	no
Software speed Switching?	yes	ves	ne
Disk speed-up software available?	yes	no	no

NOTES: All totals were conducted using the MEC V-20 microprotessor in place of the 8088 All products configured for maximum speed without host system meditications or parts replacement

intil not operate propriet with 8097 installed in best system received so parts agientil not operate propriet with 8097 installed in best system requires agitinal 8007-1 to Mitz mech co-processor chip "requires optional 8007-2 to Mixz math co-processor chip

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BACKU

HE JUICE FLOWING



puting when the power fails. It prevents the frustration and anger that naturally results when the 40-page monthly report or 5,000-cell spreadsheet you were working on vanishes along with the electricity. Emergency power protection also prevents the often unrecoverable disk damage re-

sulting when electrical failures occur at the critical instant when your computer is updating a disk's directory or file allocation table.

Although dozens of different backup power systems are available, they share the same underlying concept and are in essence simple devices. At the core of all of them is a set of batteries that store enough electrical energy to keep your computer running when no other power is available. Because all batteries can be your savior, produce direct current and all desktop PCs use alternating current, all backup power supplies also require inverters to make the DC-to-AC conversion. To keep the backup system always ready and its batteries fully charged, all systems also have built-in battery chargers.

From these components, two distinct types of backup power systems are built: the standby power system (SPS) and the uninterruptible power system (UPS). Although some manufacturers don't make the distinction and call all backup devices UPSs, the differences between the two kinds of system are par-

If your utility tends to be unreliable, a backup power system preventing data loss-or worse. disk damage-when the voltage drops.

ticularly important to PC users. Simply put, an SPS switches to its battery supply when the electricity supplied by the utility company falis. The UPS continuously operates from battery power and does not switch, using line voltage only to keep its batteries charged. A UPS will protect all computers from losing their minds during brief outages. Only a select few SPSs will protect the most finisky of PCs.

Switching from line voltage to batteries is the deciding difference. All but the brief-est power interruption—less than a few millisconds—is enough to cause some PCs to crash, in particular XTs that are equipped with power supply modules manufactured by Zenith (see sidebar "The Hair-Trigger Zenith Power Supply"). Few

running. A UPS is also better at protecting your computer against spikes and surges on the power line. When utility power is available, a standby power source connects it directly to your computer. Unless some other form of protection, such as surge protection circuitry (see "Surge Suppressors: An Ounce of Prevention . . . Magazine, Volume 5 Number 10), is built into the SPS, the computer connected to it will still be vulnerable to spikes and surges on the power line. Most SPSs readily pass along all power line overvoltages to the supposedly protected computer. Only one unit that PC Magazine Labs tested switches to battery power when line voltage becomes abnormally high (over 130 volts).

SELECTING A SINTEM When choosing a backup system, you should follow a few simple guidelines. The backup power system must have enought capacity, measured in watts or voll-surperes (VA), to power bothyour FC and its monitor. Backup time is less important. A few minutes of use crowdy in the control of the c

Remember, the power ratings commonly tossed about for the power supplies of computers are output ratings. All power supplies require more input power than they produce. For instance, a 135-watt XT may require up to 200 watts of primary proper. The cast power offereat of a compater depends on the number and kind of expansion boards and disk drives indicated in it. Thus, allowing for power factors, 2 Ce xX with monitor attached needs at least 29 to 300 VA, and more is better. ATs require more: about 400 VA to be sife. Because many manufacturers' ratings are conservative, smaller devices it can be a fine and a significant of the control of the cont

A further consideration with both standby and uninterruptible power systems is the waveform of the output: sine wave or square wave. Sine-wave current exactly

■ The backup power sources tested by PC Labs vary in size, shape, and styling more than almost any other PC accessory.

matches that supplied to you by your utility. Quarte-wave invertex are chapted and easier to make. However, square waves sometimes cause problems. At a given voltage level, square waves hold more energy than site waves and can that cause region with the contract of the

Because a power loss need not be complete for data loss to occur, a backup device should protect against sage—lemporary undervollages. If line voltage gets too low, the voltage regulator in the computer cannot make up for what's not there and the protection circuitry in the PC will shat it down. Although the PC's power supply can compensate for voltage reductions of nearly 20 percent, a deep enough temponearly 20 percent, a deep enough tempo-

rary reduction in the power line voltage the so-called brownout—will also wipe out the computer's memory. The PC is partly the cause. Its power supply is designed to turn jiself off if the electricity it sends to the computer's circuitry varies too far from the optimum. Some backup devices allowed sags of 20 percent and greater to get to the allegedly protected device.

DESIGN DETAILS When selecting a backup power system from the vast array of available units, you should carefully consider differences in design and construction.

Compared with personal computers, backup power systems are technologically primitive. They almost universally rely on linear technology, simple transformertifferiregulator combinations that hark back to the vacuous-tube days of electronics. Linear designs are relatively bulky, infedicient, and expensive, requiring large power transformers that waste energy, whiching designs, which are more comnact and much more efficient.

The backup power sources tested by PC Labs vary in size, shape, and styling more than almost any other personal computer accessory. The smallest are the size of a loaf of bread or even half a loaf. Others would dwarf the breadbox

Physical size alone can determine how the device is used, where it is located, and the trouble required in installation. Small units easily fit on or under a desk and can simply be plugged in. Some larger units might happily stand next to a desk. However, most larger backup systems are awfully noisy, making particularly obnoxious electrical whines and hums, often accented by high-speed cooling fans that run constantly. Such devices are best hidden away in a well-ventilated closet and require you to run a professionally installed, dedicated electrical line to the computer. (An extension cord defeats the purpose of the backup power source: it's all too easily disconnected, besides being unsafe.)

All backup power systems use storage batteries of some sort. The size (rating) and number of batteries determine how long the backup system can keep a computer of a particular model (PC, XT, or AT) operating. All the backup power systems tested by PC Labs used sealed, maintenance-free batteries. All of these batteries were based on some form of lead-acid technology (like automobile batteries), often using a gelled electrolyte.

Unlike the nickel-cadmium storage batteries often used in rechargeable batterypowered appliances, lead-acid cells do not have a "memory" and can be constantly kept at full charge without any reduction in capacity.

Many of the backup systems have connections for attaching additional external batteries to extend the length of the blackout protection they afford. (In every case, deep-cycle recreational vehicle or marine batteries are recommended.) Some require that these external batteries use their own battery chargers. Other systems will

charge internal and external batteries alike. A few of the backup systems offer additional features, such as individually switched outlets, that allow the backup system to do double duty as a power-control system. Most have some form of audible and/or visual indicator that warns when utility-supplied power has failed and when battery power is nearly exhausted.

Amazingly few of the backup power supplies PC Labs tested are listed by Underwriters' Laboratories, which should be regarded as a minimal level of safety and performance for any device dealing with line voltages. In fact, working with one standby power source proved to be quite a shocking experience.

No single backup power system, indeed no single power protection device, can claim to be the perfect match for every computer system and every situation. Finding the best unit requires that you compare its abilities and deficiencies with the precise needs of your computer.

THE HAIR-TRIGGER ZENITH POWER SUPPLY

The power supply Zenith made for the XT in Mexico likes the juice to stay steady—it shuts down the works almost instantaneously during a power drop.

The toughest test of any standby pow-er system is the IBM PC-XT. Some, but not all, XTs will lose all data in memory during power outages as short as a few milliseconds. Most personal computers operate unflinchingly through power failures 20 to 40 milliseconds long.

The culprit is the chrome-plated power supply module. Some XTs manufactured between the introduction of that model and the middle of 1985 use power supplies made in Mexico by Zenith that are intolerant of short power interruptions. XTs equipped with power supplies manufactured by Astec are not so temperamental.

All PCs used a special lead from the power supply to monitor whether the electrical supply to the computer circuitry is within normal limits. If the power exceeds the limits, the computer shuts down to prevent damage.

Actual DC output from all PC power supplies continues for about 30 to 45 milliseconds after utility-supplied electricity fails because of the filtering circuitry inside the power supply. With all PCs other than Zenith-equipped XTs, the powergood signal remains valid for 10 to 15 milliseconds after line voltage fails, so that shorter interruptions won't affect the computer. The power-good signal in Zenith power supplies almost immediately becomes invalid, so that such XTs shut down even though internal power may be available.

As a result, most standby supplies will not protect a Zenith-equipped XT. Three options are available: buying a UPS instead of a standby supply, buying one of the few standby supplies that switch fast enough for the Zenith XT, or putting a different power supply into the XT. In most cases, this last option will be less expensive (though probably more complex) than the price difference be-

tween a UPS and a standby supply. According to American Power Conversion Corp., which makes a special standby power supply model to handle the needs of more-temperamental XTs, Zenith power supplies can be identified in two ways. By looking slightly upward through the ventilation slots in the rear of the computer, you can see a small white sticker that says "Made in Mexico" in the Zenith supplies. In addition, the receptacle for the power line cord on Zenith power supplies is held in place by black rivets. On Astec power supplies, silver or green rivets are used .- Winn L. Rosch

MI 400

Though somewhat compact, Meirick's MI 400 packs a full 400 VA and is capable of running an XT for 38 minutes on battery power alone. As standby power sources go, it switches quickly-fast enough to keep a Zenith-equipped XT humming happily along.

Humming may be the only bad habit the MI 400 has. Once it switches to battery power, the box growls noisily. It also becomes quite warm.

The output waveform is a strict square wave, reduced in amplitude to give an approximation of normal sine-wave line voltage. That output voltage is regulated only marginally. With no load, it climbs up to 135 volts. Powering an XT, it generates about 121 volts when its batteries are fresh



MI 400 Meirick In

Power Systems Div 152 County Rd. 1040 Box 298 Friscon, CO 80443 (303) 668-3251 List Price: \$495

In Short: The MI 400 offers an excellent switch-on time, and its 400 VA rating mea 38 minutes of power for an XT. It is not UL listed but provides satisfactory power line protection

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Clockwise from the upper right: Meirick's MI 400, Electronic Protection Devices' Grizzly VRS-UPS, American Power Conversion's 330 XT+, and Dynatech Computer Power's Powerhouse.

and allows its output to tumble to 112 volts after 20 minutes of operation. Two LEDs on the front panel monitor

the MI 400's operation. A green light indicates AC power is present and in use; a red indicator lights to inform you of battery operation.

A large rocker switch on the front panel turns the MI 400 on and off. A second, smaller switch defeats the alarm beeper completely: the device then gives no audible warning. Also on the front panel is a fuseholder. Two grounded outlets are available on the rear panel.

Inside, the MI 400 tooks like something built in a garage (rather than in a factory)—but put together by a rather skilled crafts-man. All the electronics are on a single small circuit board with a power transformer underneath and four gelled-electropic batteries behind. Although the 6-inch-high by 8-inch-wide by 11½-inch-deep aluminum case is thinner than most of the other devices reviewed here, it seems sturdy enough once assembled.

The MI 400 is not UL listed. But if you're not troubled by the absence of UL's stamp of approval, it should work satisfactorily protecting any PC.

330 XT+ and 450 AT+

This set of twins, American Power Conversion Coop's 330 XT+ and 450 AT+, perform identically except for heir power ratings. Although they look like Sola Electric's SPS-300 and offer many of the same features, they are faster at switching standard by power supplies and can keep an XT equipped with a Zenith power supply running, whereas the Sola cannot.

ning, whereas the Soia cannot. The primary difference between the 330 XT+ and the 450 AT+ is power rating; the former delivers 300 VA and the latter 450. As a result of the greater capacity, the 450 AT+ can keep an XT running longer, 26 minutes as opposed to the 12 minutes 40 seconds of its smaller shilting.

Although the 330 XT+ is designed specifically to protect finicky XTs and includes extra circuitry inside for that purpose, the 450 AT+ (which is pictured four pages below) consistently switched faster in PC Labr⁵ tests.

Both units are small enough, 6½ inches high by 4½ inches wide by 13 inches deep, to fit comfortably on a desktop with your computer. Both are built into wagh sized cases, which house similar-looking fulllength circuit boards, a large transformer used during backup, and a large gel-cell battery. Only two differences between the units are visible inside. As expected, the 459.AT+ uses a physically and electrically larger battery. The 300 XT+ also has a small board added to its main circuit board, probably the switching-speed enhancing circuity. Both devices use similar mechanical relays to switch their contractions from line to battery during brownouts and failures.

Both units have four grounded outlets on their rear panels. Also there is one fuse that protects the primary circuit. Three other fuses are tucked away inside the unit.

The user controls consist of two switches: a momentary rocker switch that in one direction tests the device by manually switching over to standby power for as long as the switch is pressed and in the other direction cuts off the alarm tone. A larger rocker switch turns the output power of the device on and off.

Neither device regulates line voltage when not operating on battery power. Both switch to backup power when line voltage dips below 104 volts. An audible alarm



89 Cambridge St.
Burlington, MA 01803
(617) 273-1570
List Price: \$499
In Short: The 330 XT+ is small, lough, and quick in switching to standby power, but its more powerful sibling, the 450 AT+, is probably a better choice.

450 AT +
American Power Conversion Corp.
89 Cambridge St.
Burlington, MA 01803

(617) 273-1570
List Price: 5799
In Short: Sofficient power provided in a
deckery package makes on 450 AT a good
choice for PC protection. It won't regulate
power arrays and spakes, but, like its 330
XT+ twin, it will notive the when power dips
below 104 with a service of the power dips
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XT+ twin, it will activate when po below 104 volts. sounds when the power fails; the indication changes to warn when the battery is almost exhausted. No external alarm contacts are available.

I noted one unusual difference between the two units. The 450 AT+ hore a sticker proclaiming its UL listing. The 330 XT+ did not. Either unit is a good choice to protect any PC, but all else being equal, the bieger unit is better.

Powerhouse 300

Dynatech Computer Power's Powerhouse 300 is a solidly made, stylish standby power source capable of supplying 300 VA or running an XT without utility power for almost 28 minutes. In addition, the "UL recognized" (not UL listed) device affords full surge protection in both transverse and common modes and noise filtering on its outruits.

outplus. Three grounded outlets are available on the back panel. Also there is an unlabeled switch that defeats the loss-of-power alarm, an LED that indicates the surge pre-alarm, an LED that indicates the surge pre-holders. Laudably, both the AC line and battery protection fuses are accessible without removing the cover from the unit. No connections for external batteries or an external alarm are provided.

On the front panel is a large rocker switch that turns the output on and off and a two-color LED that glows green when normal line power is available and red when the battery supply is active.

The Taiwan-made Powerhouse 300 produces variable-duty-cycle square waves with peak and RMS values mimicking sine-wave current. Voltage regulation is quite good, varying only 2 volts (downward) from its nominal 120-volt output during the PC Magazine Labs life test. At 99 volts, changeover voltage during brownouts is somewhat low.

Notwithstanding the claim in its accompanying literature that the changeover time of the Powerhouse 300 is the fastest in the industry, the unit was only a moderate good performer. Switching in just under 9 milliseconds during simulated blackoust and 25 milliseconds, worst case, during brownouts, it was unable to keep a Zenithequiped XT reliably runnine.

Although the 5-inch high by 12-inch

wide by 14-inch deep case is attractive and nothing you'd have to hide in a closet, with the black band around its wasp-waisted middle, it would probably look better at your feet than on your desk.

Grizzly VRS-UPS

Electronic Protection Devices' Grizzly VRS-UPS lives up to only half of its acronym. Although strictly speaking it is a standby power supply and not a UPS, it does rate as Very Rapid Switching, among the fastest units tested. With 300 VA of rated output, it was able to run an XT for

over S8 minutes. Its output voltage is a pulse-width-modulated (short-duty-cycle) square wave and is quite well regulated. Its output varied anay a volt from 114 during the near-bourt is supplied standby yower. Its output is fully synchronized, and its internal relay pulls battery-powered AC co-line in just 3.6 during a latery-powered AC co-line in just 3.6 cutter [1.05] millisectored during a surge. Despite the impressive speed, however, was unable to keep an XT with a Zenith power supply reliably running.

Inside the lumpish 6-inch high by 11inch wide by 15-inch deep case are three series-connected, scaled batteries; a snarl of wiring; and several circuit boards. Surge protection is apparently hidden in a mysterious black plastic module.

The Grizzly uses a rather claborate combination of indicators to keep you abreast of what's going on inside its case. A green LED glows dirnly to indicate that its surge protection circuitry is functional. A two-color LED glows green when AC is available and red when the battery is in charge of supplying power. It pulses slow-ly when 10 minutes of charge are left, and the pulsing speecks up appreciably for a 2-minute warning.

A rather thin-sounding intermittent becper echoes the warning, also accelerating its repetition as the demise of the buttery charge approaches. A front-panel switch defeats the audible indication. A Molex connector on the rear panel warned "optional remote setus" on the evaluation sample, but the connector wasn't wired to anything on the inside.

Four grounded outlets are provided on the rear panel, as is the primary line fuse. An internal fuse isolates the battery supply. The unit is turned on and off with a front-panel switch.

tront-panet switch.

Overall, I found the Grizzly an impressive, likable unit that would do well in applications where a UL listing (which it lacks) is not important and the protected computer is not a Zenith-equipped XT.

Emergency Power System BC 425FC

Reasonably trim and compact for a standby power source of its power rating, Tripp Lite's Emergency Power System BC 425FC can supply 425 VA (340 watts) or



Powerhouse 300 Dynatech Computer Power Inc. 4744 Scotts Valley Dr Scotts Valley, CA 95066 (800) 874-2377 (408) 438-5760

List Price: \$595
In Short: Dynatech has created a solid and stylish SPS that will keep an XT going for 28 minutes. Voltage regulation is good, but switch-on-time is not fast enough for Zenith-equipped XTs.

CINCLE BY OWNEADER SERVICE CAPO

Grizzly VRS-UPS Electronic Protection Devices Inc.

35 Dunham Rd. Billerica, MA 01821 (800) 343-1813 (617) 663-0017

List Price: 5595 In Short: The Grizzly does not keep a Zenith-powered XT running reliably, but ies test performances were good and it gives an XT almost an hour of running time.

Emergency Power System BC 425FC
Tree Life

Impp Life 500 N. Orleans Chicago, IL 60610 (312) 329-1777 List Price: \$599

In Shart: The problems outweigh the merits with the BC 425FC. The quality of its power output is relatively poor, and voltage regulation is inconsistent. It does keep a Zenathcuapped XT running despite the fact that its switch-on time is fairly slow. keep an XT running for over 1½ hours. It switches fast enough to keep a Zenithequipped XT running without a glitcheven though the PC Magazine Labs test measurement showed it to be relatively slow, requiring just under 23 milliseconds to change over during brownouts and under 12 milliseconds durine power failures.

our 1z minisconois airmig power natures. One compromise in reducing the size of the BC 425°C was power quality. Its output is a stirt square wave, with its voltage reduced to give a nominal 120-RMS woll couptd. Its voltage regulation is not very good, either. With no load, it measured an aimost acray 154 volts; with an XT as load, uting the backup period. It also write to backup power at a relatively (if not damgerously) to we Svolts.

getously low so vius. Half of the inside of the 6-inch-high by 9-inch-wide by 14-inch-deep case is taken up by a single large 12-with battery. The rear half of the steel chassis is filled with transformers, three circuit boards, and a tangle of wires. An altuminar plate, which serves as a heat sink for the power semi-conductors, divides the chassis in half. Convection cooled, the BC 425F chas no fan and operates almost noiselessly, even when the battery usuptly sin use.

Two neon indicators dress up the otherwise blank black front panel: a yellow lamp indicates line power is available, and a red lamp lights to tell you battery power is in use.

All connections and controls are on the rear panel. Four grounded outlets are provided as well as an on/off switch and an alam-defeating slide switch. Two pushto-reset circuit breakers are also mounted on the back panel, one to protect the input line and the other the inverter.

A loud, defeatable continuous tone sounds during power failures. No contacts are provided for external alarms or additional batteries.

The BC 425°C waits 5 seconds after power is restored before switching from battery-powered to straight-through operation. Ordinarily that would be a positive feature, but the BC 425°C must also supply battery power—complete with alarm tone—for 5 seconds when it is initially turned on. Not only is the alarm disconcerting, but when the battery is low, the changeover relay chatters madily and the device never really finds a happy mode of operation.

operation.

Although none of the shortcomings of the non-UL-listed BC 425FC is fatal, there are enough of them to make other devices more desirable.

SPS-300

Sola Electric's SPS-300 is a standby power supply small and stylish enough to set up next to your XT without reither a building permit or an aesthetic license, yet it's powerful enough to Keep your system running through a blackout almost 15 minutes

long. The 6½-inch-high by 4¾-inch-wide by 13-inch-deep steel case neatly houses a single, full-length circuit board, a large transformer used during backup, and a large gel-cell battery. A mechanical relay switches output from line to battery during brownout and failures.

nowhord an induces.

Four grounded on the back panel, all connected in parallel.

Four fixes, in the primary circuit, is accessible without removing the case. Three other cases are the convenience of the case are the convenience of the case are the cas

When power is present, the SPS-300 passes is along without regulation to be passed in passes in the passes in the

tacts are available.

The SPS-300 returns to its standby condition when line voltage again reaches 109 volts or above. Voltage regulation during a power outage is very good. Another warning, almost exactly I minute before back-up power is exhausted (assuming you are drawing the load of a standard IBM PC-XT), is sufficient to allow you to continue mormal computing and shut down your

system without losing any of your work.

Switching time during sags was among the fastest measured, 5.4 milliseconds, and about the same during total blackouts. It was not fast enough to keep a Zenithequipped XT running, however. The SPS-300 is UI. listed.

SPR-350

Elgar Corp.'s SPR-350 is a chunky (6 inches high by 11 inches wide by 3 inches deep) standby power supply with the rated ability to carry an XT or AT through most outages, 350 VA. Somewhat squat and unstylish, the Elgar would fit comfortably under a desk.



SPS-300 Sola Electri

1717 Busse Rd. Elk Grove Village, IL 60007

(312) 439-2800 List Price: \$599

List Price: \$599
In Short: The SPS-300 is small in size but adequate in power. It will keep a PC running for almost 15 minutes. Voltage regulation is

good, and switch-on time is very fast ORCLE 602 ON READER SERVICE CARD

SPR-350 Elgar Corp. 9250 Brown Door

9250 Brown Deer Rd. San Diego, CA 92121 (800) 854-2213

(800) 44-ELGAR List Price: \$625

List Price: \$625
In Short: The lack of adequate voltage regulation makes it impossible to recommend the
SPR-350 despite its good workmanship. And
while its blackout switch-on time is fine, its
brownout time is unsatisfactory.
GPACE ETION PRICE RESPONSE AND

DataSaver 400 Cuesta Systems Corp.

3440 Roberto Ct. San Luis Obispo, CA 93401 (805) 541-4160

List Price: \$695 In Short: It's only 2 inches high, but the DutaSaver performs well, providing an XT with 34 post-blackout minutes of power. Voltage

regulation is marginal, but its switch-on time is one of the quickest for an SPS. CRCLE 880 ON NEADER SERVICE CARD Throughout the unit, the made-in-Mexico workmarship rates quite high—with the exception of the remote-indicator connector. This connector, a female DB-25, appears to be an afterthought grafted on. A full 25-wire ribbon connector is folded through the seam where the aluminum case closes, only to be crudely chopped off inside with a single pair of wires wandering off toward the main circuit board.

The three varistors attached to the output receptacles as surge protection also look like an afterthought in comparison with the compact and neatly laid-out internal circuitry.

Standby power is supplied by four gelled-electrolyte batteries connected in series. No external connections are provided for auxiliary batteries. With the internal batteries alone, it was able to keep our test XT running for a full 50 minutes.

The SPR-350 has four grounded outlets on the rear panel. On the front is the single control, an on/off switch, and an indicator light. A fuse in the primary circuit is accessible on the rear panel. A fuse in the battery circuit is hidden inside the unit.

The unit is quiet until the power fails, then hums slightly and a warning beger intermittently sounds. Performance is not up to the standard of the workmanch. Output is unadorned square waves. Vollage regulation is poor. When the battery initially kicked in, with no load, the output was measured at an unnerving [52] own. When the whole was measured at an unnerving [53] own when the work was the subject to the standard with the work of the work of

During a simulated brownout, switching times were as high as 30.8 milliseconds, not fast enough to keep an XT with a finicky Zenith power supply running. It did, however, switch much faster during total blackouts, in under 7 milliseconds.

The dangerously high output voltage and lack of UL listing militate against a recommendation of the SPR-350.

DataSaver 400

When you first look at Cuesta Systems Corp.'s DataSaver 400, you might think that the unit is very optimistically rated; you'd never expect 400 watts from a 2inch-high package that fits neatly under-



From left to right: Sola Electric's SPS-300, Elgar Corp.'s SPR-350, Tripp Lite's Emergency Power System BC 425FC, and Cuesta Systems Corp.'s Datasaver 400.

neath a monitor. Slide off the lid, and you may revise your thinking.

Inside is one of the cleverest engineering jobs around. The left and right sides of the case are lined for their full length with gelled-electrolyte batteries, connected in series to produce 24 volts and able to keep the system running for a full 34 minutes with an XT as the load.

In the center is a toroidal power transformer. A compact circuit board behind the front panel completes the design. The combination of the high performance, compact toroidal transformer, and the relatively high voltage of the system lets the DataSaver deliver so much for its small

The DataSaver wins high marks for its convenience features in addition to its remarkable packaging. It has three grounded outlets on its rear panel that are protected by backup and a single outlet that is not—a perfect place to plug in your printer (as long as it doesn't draw too much power. a Hewlett-Packard Laserjet tripped the circuit breaker that protects this outlet). Thus the DataSaver can do double duty as a power distribution system.

line voltage protection only to the convenience outlet (batter) power is protected by an internal fuse). The system will connect to external battery power and can even be used as an inverter to power your computer or what have you at a primitive, powerless location. (Of course, it requires a 24-

volt battery supply!)

A front-paniel rocker switch controls output power. Two LEDs indicate the mode of operation. One changes color from green to red and flashes when power lattery specify starts to red to the control to the color to

The DataSaver produces a reducedduty-cycle rectangular wave, synchronized to the power line, that has the same peak and root mean squared (RMS) values (a geometric average) as a sine wave. It has built-in noise and spike protection, however, only between the hot and neutral lines.

Notepads to num

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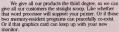
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Clockwise from the top right: Para Systems' Minuteman 500, Control Technology's RBS=AC Zero Switch, Sun Research's SR-3, and American Power Conversion Corp.'s 450 AT+.

No ground-mode protection is afforded. The DataSaver's voltage regulation

was marginal. With an XT as load, its output rose as high as 134 volts. It is also relatively insensitive to brownouts, allowing line voltage to tumble to 99 volts before kicking on with some relay chatter.

Although the DataSaver was among the faster standby supplies, switching in under 17 milliseconds during outages and just under 13 milliseconds during simulated brownouts, it was not fast enough for an XT with a Zenith power supply.

Overall, I found the DataSaver likable, primarily because of its convenient size, and it would be a welcome addition to any system other than a Zenith-equipped XT. It is UL listed.

SR-3

Sun Research's SR-3 is a standby power supply nominally capable of supplying 300 VA when line power fails. However, it has little to recommend it for protecting personal computers.

The SR-3 was among the slowest switching of the standby supplies we tested, requiring 28.6 milliseconds to change over to battery power during a simulated blackout. Its brownout performance was even worse—it passed through power line sags that dipped as low as 95 volts. Nevertheless, it was capable of keeping an Astec-equipped XT running (although not one with a Zenith-made power supply).

Despite the low changeover voltage, after the battery supply of the SR-3 had switched on, voltage regulation was very good; it kept within a volt of 117 for the duration of battery life. The output waveform looked something like a sine wave, allough it was fife with distortion. With a 135-watt XT as load, the battery lasted for inst over 23 minutes.

Although its power capabilities are modest, the SR-3 is quite large, 15 inches high by 9 inches wide by 25% inches deep, Little of the vast space inside the SR-3 is actually used, however. Its active circuity is mounted on two-circuit boards in the up-per half of the front of the chassis. The battery is just beneath. For its power rating, the transformer in the rear is humongous; it's obviously guite conservatively rated.

The workmanship inside is at best mediocre. The SR-3 looks more like something from a custom workshoo than a commercial product. The case was ill fitting, and one oil-filled capacitor was particularly shoddily mounted.

Perhaps because of the marginal construction, one aspect of the SR-3 earns it a "not acceptable" rating. Its chassis was found to be electrically hot during testing—a genuinely shocking experience. Obviously, the device is not UL listed.

The SR-3 has two battery-backed-up outlets on its rear panel, jacks for external batteries, and a large circuit breaker protecting the battery supply.

The front panel has three indicator lights monitoring the battery charge (high, low, and charge), a meter that indicates the load current in amperes, an on/off rocker switch, and a large lamp that indicates battery operation. The SR-3 also gives an audible indication of power failure.

The battery in the evaluation sample was of doubtful condition. After being unplugged for 2 days, tumed off, and with no load attached, the battery indicators diffled from "high" to "low." After 2 weeks of shudown, the device refused to turn on and supply any electricity at all, even raw line voltage, until after the battery received a charge. The changeover relay merely chattered.

RBS=AC Zero Switch

Control Technology's RBS=AC Zero Switch was the fasset-switching standby power supply we tested. Under blackout conditions, its outputs were running on battery power in just over a millisecond, at their seconds, but still quick enough to protect seconds, but still quick enough to protect any PC. Note, however, that to get this performance you need the Zero Switch on, which is a must if you are protecting to the protection of the protection

an XT.
Rated power is 500 VA, enough even
for an AT. It was able to run an XT for 50
minutes. The secret underlying the fast
switching times is probably the solid-state
relay inside the case. (Most other standily
supplies use mechanical relays.) Its support circuitry is laid out on three circuit
boards that filt the case, along with two
large, series-connected, gelled-electrolyte
batteries and alraye transformer.

The RBS=AC's designers gave some

careful thought to the protection needs of the PC. In addition to blackout protection, the RBS=AC also includes a noise filter and a novel form of surge protection. Not only is its voltage regulation good when power dips down, but in the event of a surge over 130 volts, the RBS=AC disconnects from the power line and supplies the protected device from its battery at the normal regulated voltage.

The output waveform of the RBS=AC looks unusual when displayed on an oscilloscope—the company describes it as a "harmonically limited rectangular wave"—but it appears to power computers perfectly well. When tested with a normal light bulb as the load, the bulb momentarily brightened at the instant of

FACT FILE

changeover. However, output voltage of the RBS=AC never exceeded the normal peak level of the AC power line. The bulb brightened because the duty cycle of the output waveform was somewhat extended until the device settled down (after one or two cycles).

The RBS=AC is compact enough to put on or under a desk, 6 inches high by 14 inches wide by 11 inches deep, and it includes three grounded outlets, enough for most systems. It has two user controls, a system on/off switch, and an alarm-defeat switch. The RBS = AC overrides the alarm-defeat switch when battery power gets low and matters really require your attention. In addition, three LEDs monitor the device's status. One indicates normal line power, another lights for battery power, and a third indicates when the battery charge is low. An external circuit breaker protects the AC line and an internal fuse protects the battery

The RBS=AC has but two weaknesses: no UL listing and a few unmarked components—specifically power transistors—in its circuitry. Such unmarked components can make outside servicing difficult. Nevertheless, it rates as one of the few standby supplies usable with any PC.

Minuteman 500

Para Systems Minutenan 500 is a medium-duty, 500-VA, standby power source that's packaged in an unattractive gray steel case that would be most at home suffed into a closet. It packs a foot flower in that 6V-inch-high by 10V-inch-wide by 15-inch-deep case, however: four 6-volt gelled-electrolyte batteries, to be specific, almost an hour of power for an XT.

A commensurately large transformer, isolated with thin rubber padding to reduce hum during operation, no less than three separate circuit boards, and a large cartridge-style fuse share the inside of the case.

The Minuteman is made in Taiwan, which in itself is neither good nor bad. Alas, the integrated circuits of internal circuitry have had their identifying markings removed, making repairs, other than by the original supplier, a chancy affair.

Although literature accompanying the

proved" outlet receptacles on the front panel, the device itself is not UL listed.

panel, the device itself is not UL listed.
Also on the front panel, three LEDs
serve to monitor the device's function. A
green diode indicates that AC power is
alive and well, a flashing yellow diode indicates that the battery supply is in service,
and a flashing red diode gives a nominal 2minute warning before power runs out.

■ The Minuteman's integrated circuits of internal circuitry have had their identifying markings removed, making repairs a chancy affair.

A fusi-holder (protecting the primary) and two additional controls also bedeck the frost panel: a red button to silence the power failure alarm (which becomes intermitent when Z minutes of power remain) and an onoff rocker switch. A large fusi-holder (nonstandard), terminals for an external 24-wolt battery, and two large heat sinks are mounted on the rear.

Metal-oxide varistors, visible inside the unit, apparently serve as surge suppressors. The manufacturer also claims three stages of power conditioning.

Despite its ability to carry a lead for \$5 immunes, the filmunesh rest results were disappointing. It is apparently overregulated, increasing its output voltage to a dangerous 138 volts under load, as the battery claim of the state of the

Because of its questionable performance, its doubtful serviceability, and its lack of UL listing, the Minuteman rates as a substandard power-protection selection.



SR-3

Control Technology Isc.

\$200 N. Classen Bivd., #101
Okthobera City. OK 73114
(405) 840-3163
List Price: \$5699
In Short: Control Technology has built the featest-switching power supply around. The reason: a solid state relay. The RBS = AC is not UL listed, but it provides good power-interruption protection for any PC.

CPICL 886 OF ACMEDIA STRUCK CAND.

Para Systems Inc.
11425 Mahis St., #004
Dallas, TX 75234
C214) 869-1688
List Prices 5699
I as Short: The Minutensia performed poorly
during testing, and repairs are difficult because of a lack of identifying markings on the
circulary. Its awhich-on time is unacceptably
ONES INNOVALENT REPORT CAND.

SPS-400

Though somewhal large (15 inches high by 7 inches wide by 18 inches deep) for its AT-sufficient 400 VA power rating, Sola Electric's SPS-400 will provide over an hour of sine-wave backup power to a standard XT. Alas, the SPS-400 lumbers along when it comes to switching its output when the power fails and is unable to keep an XT with a Zenith power supply operating.

with a Zenith power supply operating. The SPS-400 chibbled definite problems handling lower-than-normal voluge conditions. After switching over to be output voltage to increase to its nominal level. During the transition between line and battery power-to-me strange was the proper to the proper to the conposition of the proper line. It often permanent to the power line, it often (but not always) switched on 180 degrees out of phase.

out or passe.

The SPS-400 is also somewhat reluctant to switch to battery power. Despite its pescifications, which call for switching when utility power dips 15 percent below the nominal 120 line voltage, the test unit would not switch until power dipped to 98 youts. Moreover, switching time itself rates as only mediocre, 38 6 milliscootd untip a simulated brownout, almost 17 milliscootds (the worst case) during a simulated brownout, almost 17 milliscootds (the worst case) during a balactout.

Two standard grounded outlets are provided on the back panel. Also there are a 5amp fuse in the primary circuit and a 1/ainch phone jack for connection of a remote power-failure indicator.

The SPS-400 also has an internal-lossof-power indicator—a becper that sounds for approximately 1 second every 20 seconds. This indicator may well be superfluous, however, considering the cacophony the SPS-400 creates when generating its own power. Besides the roar of its internal fan, it emits a loud electro-oscilliatory whine. In normal operation with line voltage, however, it is very quiet and would be a reasonable deskide companied.

The SPS-400 is well made, with a sturdy welded-steel chassis under its steel case. The bottom channel of the chassis is connected with a series pair of 28-amphour (that means big) gel-cell batteries; the top contains one large circuit board, a

transformer, and the fan.

The only user control is an on/off rocker switch on the front panel that illuminates to show that normal line voltage is present.

The unit is UL listed.
Although it is well made, the SPS-400's performance does not recommend it for personal computer applications.

Micro-250

Imunelec's Micro-250, now sold as the MS-300, is a likable, truly uninterruptible power supply. Rated at 250 VA, it offers perfect protection for any PC or XT against any sort of power-line problem.

any parties apported in proceedings of the 250 are miror and in no way interfer with its operation or the protection it provides. Although Immade claims its output is pure sine wave, PC Magazine Labs test photographs show it to be severely photographs show it to be severely served in operating a PC with it. Ratel voltage is 120, but nominal output voltage was somewhat lower, 114 for most of the test period, rising somewhat as the battery discharged. The markings have been removed the procession, making more discovered and the process, making the productions of the process of the process of the proteers of the process of the process of the process of the proteers of the process of the process of the process of the proteers of the process of the process of the process of the proteers of the process of the process of the process of the proteers of the process of the process of the process of the proteers of the process of the process of the process of the proteers of the process of the

Although stylistically far removed from look of a FC, the 5-inch-shigh by 15-inch-wide by 10½-inch-wide polytical for a few polytical finished steel case are a pair of identical transformers, a couple of circuit boards, and a pair of botteries. The skip pair is lined polytical for a few polytical few

The internal batteries were sufficient to power an XT for 20 minutes. For longer periods of protection during prolonged outages, an external combined battery pack and charger is available.

The Micro-250 has only one output receptacle. Two other small connectors decorate the rear panel; however, their function was not documented in the materials we received with the unit. An AC line fuse is provided on the rear panel; a battery fuse is located inside on one of the circuit boards.

Three LED indicators monitor the functioning of the Micro-250. One indicates that AC power is available, another indicates it is not, and a third indicates overloads. An intermittent beeper, which sounds about once every 8 seconds, indicates a power failure. The only user control is a large, square nonilluminated on/ off push-button switch.

The Micro-250 is UL listed, and it offers the ultimate in power protection in its power range.

SR-30

Sun Research's SR-30 is a true uninterruptible power supply, converting battery DC to AC whether or not normal line voltage is present. It never switches, so its output is

FACT FILE

SPS-400 Solu Electric

1717 Busse Rd. Eik Grove Village, IL 60007 (312) 439-2800 List Price: \$845 In Short: The SPS-400 is well made, but its performance at lower-than-normal voltage

conditions is unsatisfactory. Switch-on time is relatively slow. GROLE 674 ON FEADER SERVICE CARD

Micro-250 Imunelee Inc

517-G Acom St. Deer Park, NY 11729 (516) 667-1331 List Price: \$897

In Short: This French-made UPS, rated at 250 VA, provides the ultimate in protection in its power range. Any PC will be well protected from any kind of power irregularity. The unit is now rold as the MS-300.

The unit is now sold as the MS-3 CIPCLE 684 ON READER SERVICE CARD

SR-30 Sun Research Inc. P.O. Box 210 New Durham, NH 03855 (603) 859-7110 List Price: 5995

In Short: Its noise and large size relegate the SR-30 to a place far from the desk, but this UPS would be a formidable contender if the supplied battery were of higher quality. GROLE SEE ON PERSON SERVICE CARD. never interrupted, even for a moment.

For its power rating, 300 VA, the SR-30 is large (16 inches high by 9% inches wide by 25 inches deep) and heavy, designed to sit on the floor (and a sound one at that). It's also noisy; its cooling fan runs constantly. The noise and its appearantly like a piece of help lab gear, probably rule out installing it next to or near a desk; it's more of a candidate for the lab, power closet, or wherever you keep your primary protocols every.

Inside its aluminum case, the SR-30 looks like a piece of custom-made lab equipment, with no fewer than six circuit boards and an est to foundled wining. Decoraing the front panel are a meter that readindicators for high and tow battery condition, charge, whether the invester is operating, thermal overload, and whether poser is cartually being supplied. The rear ery circuit fuse, a circuit breaker, and connectures for external 2-voit batteries.

The SR-30's output is a clean sine wave. Because of its UPS design, it has no measurable switching time. Further, its voltage regulation is superb; it didn't vary throughout the entire test range.

The principal problem we encountered with the SR-30 stemmed from what was apparently a defective battery. After 4 days of charging, it was capable of supplying our test XT for only about 30 minutes. Also, the lower power/imminent failure warning came on quite permaturely. Sun recommends external batteries (marine type, deep cycle), and we have no doubt that, equipped with them, the SR-30 would be a formidable contended.

Defender

Computer Power's Defender is like a bigbrick. Big because its case measures 7 inches high by 17 inches wide by 20 inches deep, and a brick because it just sits around noiselessly. That's because, despite the label 'uninterruptible power supply,' on the front panel, it's a standby supply, and when power is available it does little more than charge its 12 batteries.

When power fails, it snaps into action, supplying up to 600 VA with enough reserve to run a standard XT for nearly 3



From left to right: Sun Research's SR-30, Sola Electric's SPS-400, Computer Power's Defender, Topaz's Powermaker 84864, and Imunelec's Micro-250.

hours. Alas, although it switches to battery power quickly, in under 5 milliseconds in a blackout and just under 30 when the voltage sags, it's not fast enough to keep a Ze-

nith-equipped XT from crashing. The output waveform when the battery supply is active is a clipped sine wave; oursupply is active is a clipped sine wave; ourput voltage with an XT as the load is well regulated at about 123 volts. It's sensitive to the slightest edge, switching on a 109 volts and off at 118, which means it may volts and off at 118, which means it may time after acratel electricity returns. When its battery supply is not active, the Defender does not require line voltage.

The single user control is an on/off rocker switch on the front panel. A green light above it indicates normal line current is available; a red lamp below indicates the battery supply is active.

Four grounded outlets are available on the rear panel, as is a primary circuit fuse and a connector for a remote alarm. SPDT (single pole double throu) contacts. SPDT provided. The battery circuitry is protected by an internal fuse. Although there is an internal alarm, it might be unnecessary because of the commotion the Defender makes when generating its sown Dr. wer—a wind-machine-style fan accompanies a plaintive electrical whine.

The circuity inside is nicely laid out with the dozen batteries, connected so as to give rwin 36-volt banks on the left, transformer, fan, and active circuitry on tright. No sound isolation is used in the unit, and the electrical assembly, directly mounted on its own subassembly, is directly mounted on the chassis. The Defenderis not UL listed.





Users have been telling us that the next thing they want from Lotus is more and better graphics. Everyone at Lotus agreed.

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Of course, everyone's read what the press has been saying. R. Magazine included it among their "Best of 1985;" PC World named it "Pacesetter Product of 1986; because of its outstanding depth and ease-of-use. The Datapro Report spent 12 pages explaining why Freelance deserves their highest graphics product rating ever.

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CIRCLE 368 ON READER SERVICE CARD

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Clockwise from the top: Triad Power Systems' Tri-UPS 300+600, Triad's Tri-UPS 600+600, Electronic Specialists' SineUPS SU-250, and Sola Electric's MINI UPS 400.

Powermaker 84864

Topaz's Powermaker 84864 is a standby power supply, in more ways than one. It switches to battery power during outages, and its tall, narrow case will be most at home standing by your desk.

The Powermaker's apparent design goal was ease of use. It features one control, an on/off switch, and two indicators: a light in the switch indicating power is available and a warning beeper that sounds once every 8 seconds to indicate that the Powermaker is indeed making its own power. An optically isolated circuit for an external warning device is also available. Four power receptacles are provided on

the rear panel, where a replaceable primary line fuse is also located.

The Powermaker is a heavy-duty device, rated at 800 VA and able to run an XT for 2 bours and 20 minutes in case of an

X1 for 2 hours and 20 minutes in case of an outage. Inside its case, the output transistors in the inverter are fan cooled, and the hefty inverter makes an audible whine during operation. (It's silent when line voltage is available.)

When tripped on by a voltage dip to below 105 volts or total power failure, the unit switches on quickly, 10 milliseconds worst case—although it may require onehalf to one full cycle for its synchronized, clipped-sine-wave output to fully stabilize. Voltage regulation is superb.

The Powermaker performs a self-test when it is initially connected to its load, supplying battery power for about 3 seconds before switching over to line power. About the only thing lacking is some indication that the battery charge is running low.

UL listed, the Powermaker 84864 is a suitable standby power source for large installations where its large reserves can be put to use, although not with systems using Zenith-equipped XTs.

SineUPS SU-250

A true UPS, Electronic Specialists' Sine-UPS SU-250 is capable of supplying 250 watts of near-sine-wave (severely clipped) power and running a 135-watt XT for almost 15 minutes on its internal batteries.

most 15 minutes on its internal batteries.

Compared with other UPS designs, the
SineUPS regulates its output poorly. During its 15 minutes of battery operation, its
output voltage fell from 112 volts, already

low, to 101 volts, a point at which computing is tentative at best.

Nevertheless, it runs as a UPS should. There was no difference in its output whether or not AC input power was present. It will keep any PC—including a Zenith-equipped XT—on through brief blackouts.

Perhaps the most novel part of the Sing-UPS design is its use of a suck of the Civil UPS design, however, in that the Singture of the Sing in the Sing is the Sing is of the UPS is still bulley, In tinches high by 10 inches wide by 22 inches deep, and relativelynoisy for a flaness design. The transformers are the chief contributors to the AC hum the unit enits. Otherwise, the Sincl UPS' internal design and construction is cluttered but workmanike.

The front panel holds two switches: one turns the SineUPS and devices connected to it on and off; the other is a momentaryaction test switch that temporarily disconnects the AC input from the battery system to verify that all is working well.

Several LEDs on the front panel monitor the SineUPS's operation. One green LED indicates that the AC line is present, another shows that the internal batteries are being charged. Red LEDs illuminate when the remaining battery charge is getting low or when the system is overloaded.

The front-panel beeper supplements the LEDs. It was apparently defective in the evaluation unit: it emitted a single, soft, hyenalike laugh when power failed (or dipped below 101 volts) and remained silent thereafter. In theory, it should have sounded before the SincUPS shut down because of battery discharge. It did not. External alarm contacts are not available.

Four grounded outlets are mounted on the front panel. The rear of the unit is devoted to a large heat sink, a noise filter, a single circuit breaker protecting the input line, and two jacks for the LightUPS system, a low-voltage output designed to opcrate a workstation light during power failures. The SinceUPS is not UL listed.

Tri-UPS 300+600

As its name implies, Triad Power Systems' Tri-UPS 300+600 is a true uninterruptible power supply able to supply 300 VA (240 watts) of battery power continuously. It has sufficient reserves to keep any variety of XT running for a full 52 minutes after utility power fails

Only inches smaller than the size of a PC system unit, 5 inches high by 17 inches wide by 16 inches deep, the Tri-UPS



FACT FILE

Powermaker 84864 Topaz Inc. 9150 Topaz Way San Diego, CA 92123 (619) 569,7982

List Price: \$1,020 In Short: Toraz's SPS, rated at 850 VA, is designed for heavy-duty use. It will keep a standard XT glowing for 2 hours 20 minutes. and its voltage regulation is superb. CIRCLE 600 ON READER SERVICE CAR

SineUPS SU-250 Electronic Specialists Inc 171 S. Main St Namel: MA 01760 (800) 225-4876

List Price: \$1,095 In Short: The SineUPS does not regulate its output as well as most other UPSs, but it runs well enough to keep any PC, including Zenith-powered units, functioning in a blackout

CHICLE #72 ON READER SERVICE CAR

Tri-UPS 300+600 Triad Power Systems 10362 Miller Rd Dallas, TX 75238

(214) 341-8700 List Price: \$1,095 In Short: This is a UPS that scores highly in the design, workmanship, voltage regulation and power departments. Its informative LED

bar graphs are a welcome departure from the typical flashing indicates lights ORCLE 678 ON READON SERVICE CARE

Tri-UPS 600+600

Triad Power Systems 10362 Miller Rd. Dallas, TX 75238 (214) 341-8700

List Price: \$1,495 In Short: The Tn-UPS 600+600 is large and powerful enough to protect almost any PC. XT, or AT from sudden power loss, and its excellent switch-on time is first enough to ac-

commodate the especially sensitive Zenith cower supply.

PROLE 679 ON PE

300+600 also features two conditioned (but not battery-backed-up) outlets for running noncritical peripherals. Four red rocker switches on the front panel allow you to switch each individual outlet on and off as needed. A master on/off switch is located on the back. The Tri-UPS 300+600 can thus serve admirably as a power distri-

bution center. The front panel also holds an additional indicator panel with two LED bar graphs that show the amount of battery charge remaining and the magnitude of the electri-

 The Tri-UPS 300+600's indicators are much more informative than a single LED.

cal load the UPS section is supplying. These indicators are welcome in that they are much more informative than the single flashing LED used by most standby supplies. PC Magazine Labs technicians were not reassured when the battery-level indicator dropped to about half-scale after but a few minutes of operation. Nonetheless, the Tri-UPS 300+600 kept running for a long time afterward.

Output voltage is well regulated at 115 volts; it didn't change over the entire period of backup operation. The output waveform is a reduced-duty-cycle square wave with peak and RMS values approximating those of a true sine wave.

A continuous warning tone sounds when line voltage dips below about 76 volts (remember, because this is a true UPS, the output never switches). This warning can be defeated by pressing a button on the front panel.

Inside the steel case, the design and workmanship rate as among the best. All components on the single large circuit board are plainly labeled. Sharing the inside are three series-connected, gelledelectrolyte batteries and a single large transformer. A low-speed, audible (but barely so) fan keeps everything cool. The "conditioned" outputs are appar-

ently protected by a large RFI filter and a varistor. The single fuse in the rear panel disconnected only the conditioned outputs, an unusual design. No fuse or circuit breaker is apparent in the battery-backedun circuitry. The device is UL listed.

Triad Power Systems' Tri-UPS 300+600 would be an excellent choice for backing up any PC or XT.

Tri-UPS 600+600

A true UPS, Triad Power Systems' Tri-UPS 600+600 is powerful enough to run almost any PC, XT, or AT system with a rating of 600 VA (480 watts). Its full frontpanel switching center and extra line-conditioned (though not uninterruptible) outlets make it a complete power-control

A relatively big unit, about the same size as a PC system unit (5 inches high by 191/2 inches wide by 171/2 inches deep), the Tri-UPS 600+600 packs enough battery power-six separate gelled-electrolyte batteries-to run a 135-watt XT for almost 2 hours. During that time, the protected computer gets pulse-width-regulated, 114volt, square-wave power that varies not a volt. When the batteries are completely drained, the Tri-UPS 600+600 immediately shuts down, and its output voltage almost instantly falls to about 1/100 volt, so that there is never any chance of equipment

Two uninterruptible grounded outlets on the back panel are each controlled by a senarate, illuminated red rocker switch on the front panel. Two other convenience outlets on the rear panel are also individually controlled from the front. These convenience outlets are protected against overvoltage transients. An overall master switch on the rear controls all outlets.

A rear-panel fuse protects only the convenience outlets. Internal fuses supply the current limiting for the UPS circuitry.

The two handles on the rear panel are far from being the decorative device often appended to home stereo equipment. They offer a good means of moving the heavy beast around. Two LED bar graph indicators on the front panel indicate battery con-

dition and the UPS load. When line voltage falls below 76 volts, a continuous-tone alarm sounds. It switch-

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CIRCLE 228 ON READER SERVICE CARD

es off when line voltage reaches 99 volts or when defeated by a button on the front panel.

Overall construction is very good. All the active circuitry is contained on one large circuit board, to which are attached several large heat sinks for nower semiconductors. These are cooled by a fan which, in the evaluation unit, was very noisy and possibly defective.

UL listed, the Tri-UPS 600+600 is suitable for protecting any computer system and will not fail you if you have a Zenith-equipped XT.

MINI UPS 400

Although the specifications of Sola Electric's MINI UPS 400 make it seem like a premier personal computer UPS, its idiosyncracies overrule its utility. On paper, the numbers are impressive. The MINI UPS is rated as more than capable of running any PC system at 400 VA (320 watts) with enough reserves to keep a 135-watt XT purring happily for about 77 minutes.

The unit is big for its rating-12 inches high by 12 inches wide by 20 inches deep. A true UPS, it never needs to switch to battery power, and so it will keep even a Zenith-equipped XT operating during a blackout. Its clipped-sine-wave output is well regulated, never varying from 116 volts during the backup period.

Getting a computer connected to the MINI UPS is another matter. You cannot (at least, you should not) use the on/off switch on the front of the MINI UPS to control your computer system. The MINI



MINI UPS 400 Sola Electric

1717 Busse Rd. Elk Grove Village, IL 60007

(312) 439-2800 List Price: \$1,716

In Short: The MINI UPS is too temperamen tal to merit an endorsement. It requires voltage build-up time and therefore does not allow the PC to boot up properly. The perforated casing keeps the unit cool but un-

CIRCLE 675 ON READER SERVICE CAON

UPS has a substantial "walk-up" period during which its output voltage builds to its nominal value. Thus, for the first few seconds (up to about 10) its output is well be-

low what a PC requires. Even once the MINI UPS stabilized, PC Magazine Labs technicians had problems getting the test XT running. Turning on the system unit and monitor simultaneously caused enough of a sag in output that the computer would not boot. The technicians had to switch on the computer and monitor separately to get the system working at all.

As for its physical appearance, the MINI UPS is more caged than packaged. Its case is almost entirely perforated. Although perhaps too unaesthetic to install near your desk, the unit is ventilated well enough to not require a fan, a design that should increase reliability and reduce

 Even once the MINI. UPS 400 stabilized. PC Magazine Labs technicians had problems getting the test XT running.

noise. Alas, even without a fan the MINI UPS is noisy, emitting a constant loud (and

objectionable) inverter whine. All the essential controls and connections are located on the device's front panel, including two grounded outlets, a fuse in the input line, an on/off switch, and lights indicating that line voltage is present, that the internal battery charger is op-

erating, and that the internal inverter is functioning properly. On the rear panel is an inverter-defeat switch (for safe storage), a jack for an external alarm, a battery fuse, and connections for external auxiliary batteries to sup-

plement the 36 sealed lead-acid cells in the bottom of the unit Overall, the MINI UPS appears too temperamental for PC installations.



Benchmark-Testing Backup Power Systems

C Magazine Labs evaluated all the backup power systems, whether standby or uninterruptible, using the same test proce-

Line voltage regulation was monitored by varying the input voltage with a Variac and observing the output of each unit with a 8810A/Digital Multimeter laboratory RMS voltmeter. Voltage regulation during battery operation was monitored by the same meter.

Waveform was determined by monitoring the output of the backup device with a Tektonix 100-MHz Dual-Trace Digital-Storage oscilloscope.

TRANSFER TIMES

Transfer times were measured by using one trace from the oscilloscope to monitor line input to the backup device, while the other trace monitored output. The results, shown on the oscilloscope screen, were photographed, and the times were computed by direct measurement. The photographs were also used to determine whether the output was synchronized to the power line. The transfer times given in the test results chart on the facing page represent measurements made during brownouts, when input voltage was reduced to 100 volts for several cycles, and blackouts, when input power was totally interrupted. In both cases, faster is bener.

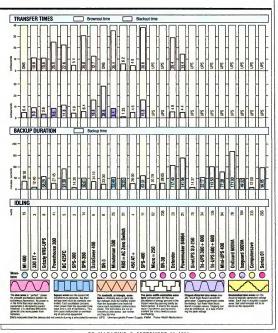
BACKUP TIME

Backup devices were also checked for their ability to keep two standard XTs operating. One XT was equipped with a Zenithmanufactured power supply, the other with a power supply manufactured by Astec.

Each backup device was charged for at least the manufacturer's recommended period for a full charge, then allowed to power a 135watt XT (Astee-powered) until failure. The total time the XT was able to operate is given in the test results chart.

IDLING

Idling shows the amount of power that a unit required during no-load idle operation with baneries at full charge. A lower figure represents a more efficient unit. -Winn L. Rosch





Clockwise from the upper right: Imunelec's Series 01, Clary Corp.'s OnGward 600VA, Isoreg Corp.'s Isoguard 500VA, and Computer Power's Computersave.

OnGuard 600VA

Clary Corp.'s OrGuard 600VA has the makings of the perfect UPS. it's functionally invisible. Whether or not line voltage is available, it constantly supplies up to 600 VA of nearly pure sine-wave power at an almost unwaying 120 volts. It proved itself capable of running a 135-watt PC-XT for almost 3 hours (171 minutes to be precise) using its internal gelled-electro-lyte batteries.

Although big (16½ inches high by 9½ inches wide by 28½ inches deep), the On-Guard rates as a comfortable deskside companion. It's pleasantly styled and makes no noise except for the subtle spinning of its cooling fan (likely quieter than the computer it is protecting).

When the power fails or line voltage drops below 66 volts, almost nothing changes—a couple of indicators go out and an alarm sounds once every 10 seconds. Otherwise there are no clicks, dips, or flashes and no discruible change in the OnGuard's output. Even a Zenithequipped XT will keep going without a problem.

Six front-panel indicators allow you to

monitor the condition of both utility and backup power. Three green lamps indicate that the inverter is working, that utility power is available, and that the battery has sufficient charge. Three red lamps warn of overloads, low battery, or a "bypass" condition

Byposs means that the OnGuard has connected its output directly to the power line because of an internal problem. Thus, even if the OnGuard fails, you can keep computing. (During testing, the bypass lamp flickered when an XT system was turned on, but no robolems developed.)

The OnGuard's rear panel has four grounded outles, a circuit breader (which merely disconnects line voltage but does not switch off the OnGuard), and a terminal strip for external connections. Screw terminals are provided for remote operation (which is one way to defeat inverter operation) and external alarms for power failure, low battery, and internal failure.

Although not ÜL listed (the identification plate states only "UL Design"), the OnGuard seems capable of securely supplying genuinely uninterruptible power to all but the most elaborate personal computer systems.

Isoguard 500VA

A truly uninterruptible power supply, storge Corp. is stoguard 5000/A will handle loads of up to 500 VA and keep an ordinary XT running for almost 50 minutes. Its almost-sine-wave output (distortion well exceeds the 3-percent figure claimed) and high-quality construction make it a good choice for a protection device. It leaks only a UI. Isting for your peace of mind and a quiet fan for just plain peace.

The Isoguard's heavy aluminum case, 7 inches high by 17 inches wide by 18½; inches deep, resembles laboratory equipment more than anything else (except for its unusual brown-beige and chocolate-brown color scheme). Its internal construction matches the styling: neatly done with an attention to detail.

The rear of the chassis is lined with gelled-electrolyte batteries; transformers and high-power active circuitry dominate the center; and relays (solid state and mechanical) and a couple of circuit boards of control electronics fill the front. The noisy fam—a high-speed AC model—is buried deep inside and blows directly across the



OnGuard 600VA Clary Corp. 320 W. Clary Ave. Sm Gabriel, CA 91776 (818) 287-6111 List Price: \$1,895 In Short: No.IPS is more at

In Short: No UPS is more unobtrusive than the OnGuard. Its smooth operation will keep a 135-wat XT going for almost 3 hours, and it does it quietly. It even has the capability to bypass itself if an internal problem develops. CPICLE MRY ONE PROPER SERVICE UND

Isoguard 500VA Isoreg Corp. 410 Great Rd.

Littleton, MA 01460 (617) 486-9483 List Price: \$1,933 In Short: Despite a noisy fan and the lack of

a UL listing, the 500VA performs almost flawlessly and will keep an ordinary XT running for 50 minutes. It is well designed and shows attention to manufacturing detail. CHCLE 801 ON FEACH SERVICE CAID.

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ever you need to recover a damaged file - or an entire hard disk's data -BackTrack has got you covered. Tallgrass has been backing up PC hard disks longer than anyone. Now,

> cartridge tape systems, BackTrack can keep

running. Instead of down and out. Frankly, it's \$129 of data insurance you can't afford to be without

How BackTrack Works. BackTrack automatically backs up your hard disk, while you work. It won't slow you down or interfere with your programs. You'll never know it's there-until you need it.

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work directly from your backup diskettes - without restoring them first. So even if your hard disk is down, you're not!

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BackTrack is the 100% software solution to backup. Just load it onto your hard disk once and your data is

even if you aren't ready for one of our you up and

10 Ways BackTrack Gives You More. 1. Starts by itself every tir

when your computer is idle Backs up new or changed files every half hour. Interval is changeable and total backup is available

at any time. Fully menu driven with complete help text. structure, so you can use them directly off the

backup diskettes or tapes without restoring. Automatically divides large files into segments if they won't fit on one dislecte.

7. Compatible with most application programs, including RAM-resident programs like SideKick.

8. Restores one file, an entire directory, or the whole

Key Specifications
Computer 18M Pt, XT, XI, Company and Pt compatibles. Operating
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spice IV. Tape vystem Primary Hand Disks Internal or external,
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10. 30-day money-back guarantee.

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TECHNOLOGIES

Product/ Manufacturer	Price	Rated VA*	Туре	Outlets	Alarm audible	External	Runs Zenith- powered XT		Comments
MI 400 Meinck Inc.	\$495	400	SPS	2	Yes	No	Yes	No	
330 XT + American Power Conversion Corp.	\$499	300	SPS	4	Yes	No	Yes	No	
Grizzly VRS-UPS Electronic Protection Devices Inc.	\$595	300	SPS	4	Yes	Yes	No	No	
Powerhouse 300 Dynatech Computer Power Inc.	\$595	300	SPS	3	Yes	No	No	No	
Emergency Power System BC 425FC Tripp Lite	\$599	425	SPS	4	Yes	No	Yes	No	
SPS-300 Sola Electric	\$599	300	SPS	4	Yes	No	No	Yes	
SPR-350 Elgar Corp.	\$625	350	SPS	4	Yes	Yes	No	No	
DataSaver 400 Cuesta Systems Corp.	\$695	400	SPS	3	Yes	No	No	Yes	1 convenience outlet
SR-3 Sun Research Inc.	\$695	300	SPS	2	Yes	No	No	No	Load current meter
Minuteman 500 Para Systems	\$699	500	SPS	3	Yes	No	Yes	No	
RBS = AC Zero Switch Control Technology Inc.	\$699	500	SPS	3	Yes	No	Yes	No	
450 AT + American Power Conversion Corp.	\$799	450	SPS	4	Yes	No	Yes	Yes	
SPS-400 Sola Electric	\$845	400	SPS	2	Yes	Yes	No	Yes	
Micro-250 Imunelec Inc.	\$897	300	UPS	1	Yes	No	Yes	Yes	
SR-30 Sun Research Inc.	\$995	300	UPS	2	Yes	No	Yes	No	
Defender Computer Power Inc.	\$1,000	600	SPS	4	Yes	Yes	No	No	
Powermaker 84864 Topaz Inc.	\$1,020	800	SPS	4	Yes	No	No	Yes	
SineUPS SU-250 Electronic Specialists Inc.	\$1,095	250	UPS	4	Yes	No	Yes	No	Rated in watts instead of W
Tri-UPS 300 + 600 Triad Power Systems	\$1,095	300	UPS	2	Yes	No	Yes	Yes	2 convenience outlets
Tri-UPS 600 + 600 Triad Power Systems	\$1,495	600	UPS	2	Yes	No	Yes ·	Yes	2 convenience outlets
MINI UPS 400 Sola Electric	\$1,716	400	UPS	2	Yes	No	Yes	No	
OnGuard 600VA Clary Corp.	\$1,895	600	UPS	4	Yes	Yes	Yes	No	
Isoguard 500VA Isoreg Corp.	\$1,933	500	UPS	4	Yes	No	Yes	No	
Computersave Computer Power Inc.	\$2,050	750	UPS	4	Yes	Yes	Yes	No	
Series 01 Immelec Inc	\$2.603	500	UPS	2	Yes	No	Yes	Yes	

heat sink of the power semiconductors. It runs constantly.

runs constantly.

The front panel of the Isoguard is decorated with several LEDs. Two are green and indicate that all is well, one showing that line power is present and the other indicating that the inverter is supplying the load with fully protected, line-synchroided current. The rest of the LEDs are red and warn of various conditions: overloads, battery nearing exhaustion, overheating, and bypassing (or imminent bypassing) of the inverter.

An alarm supplements these visual indicators with an intermittent double beep when the line voltage dips below 55 volts or stops entirely. The alarm cannot be defeated. You can also install an RS-232 serrial port to interface the power supply directly to your computer.

The rear panel sports four grounded outlets and jacks for adding external batteries. All four fuses are internal. A switch on the front panel turns the entire device (and, of course, its outputs) on and off.

The only time the Isoguard didn't operate flawlessly was when it was switched off and then on again within 5 seconds; under these conditions, it would invariably come up in bypass mode, and the inverter would not start.

If you don't mind the fan noise and don't demand a UL listing, the Isoguard is a good choice for a well-built UPS.

Computersave

A true heavyweight, Computer Power's 750 VA (600 watts) Computersave tips the scales at over (or tips over the scales at 100 pounds. A true UPS, it will continue to supply power without the briefest pause for switching and run just about any personal computer system through brief brownouts and blackouts.

Despite its heft, however, the Computersave doesn't pack huge reserves. It was able to run a single XT for only 12 minutes. During that period, it supplied distortion-rich sine-wave power that was reasonably well regulated at 121 volts. It is not UL listed.

The short lifespan of its battery power can probably be attributed to a seemingly OPEC-influenced design that wastes energy and creates more heat than power. At an

Despite its heft, the Computersave doesn't pack huge reserves.

idle and with no load at all, the Computersave draws 330 watts!

Four backup-protected grounded outlets are mounted on the front panel. Three lamps directly above the outlets monitor power conditions. A green light indicates that AC is being supplied to the outlets, yellow shows the internal inverter is working, and red warms that the Computersave's inverter and UPS batteries have

been bypassed.

The inverter-on lamp is probably superfluous. The inverter circuitry hums so loudly that only the deaf and the dead could mistake its status.

A switch on the front panel turns the inverter section on. When off, the front panel outlets are connected directly to the input power line. Switching between inverter and line takes long enough that there's a good chance a PC would shut down in the interval.

On the rear panel, the Computersave provides jacks for external batteries and an external alarm circuit (as well as two fuses). The internal alarm is a continuous tone that sounds when line voltage dip below 102 volts and becomes intermittent shortly before battery power is exhausted. The alarm cannot be defeated.

The Computersave's large case is a two-story affair. The top is well packed with circuitry, components, and a snarl of wiring. The bottom section is stuffed with sealed lead-calcium batteries. A fain on the back panel keeps everything cool and will raise the general noise level of any office. The Computersave is thus best hidden in a closet, if anywhere at all.

Series 01

At a rated 500 VA and able to run an ordinary XT for over an hour and a half, Imunelec's Series 01 seems like overkill, but it fits the bill for a decked-out AT system. In many ways, the Series 01 is the Cadillac of backup supplies. A true UPS, the big box—24 inches high by 12 inches wide by 15 inches deep—puts out a nearly perfect sine wave. Voltage regulation is superb, varying not a bit from 118 volts, even with the widest swings in line voltage or chances in battery condition.

The materials and construction inside bear out the powerful impression given by the massive cabinet. The bottom of the case is lined with four sealed lead-acid batteries; the top contains a hefty power transformer; and the rest of the circuitry is spread throughout.

It's not perfect, however. In fact, the PC Magazine Labs technicians dubbed the PC Magazine Labs technicians dubbed the Series 01 "the UPS from Hell" because it became so hot during operation. It's also noisy, growling a steady-state 60-Hz electrical hum combined with the whir of its continuously muning fan. Run it for a day, and you're certain to exile it to a closet or some area where it won't disturb anyone.

The principal control is an on/off toggle switch atop the cabinet. Two green LEDs indicate when normal line power is present and when battery-supplied current is avail-



Computer Power Inc. 124 W. Main St. High Bridge, NJ 08829 (800) 526-5088 (201) 638-8000 List Price: \$2,050

Last Price: 32.00 pound behemoth performs as a UPS should, but it keeps an XT going for only 12 minutes. The unit draws 330 watts at rest, and its fan noise makes a closet placement almost mandatory. GPGLEST OMERGES SERVICE GND

Series 01 Immeteic Inc. 517-G Acom St. Deer Park, NY 11729 (516) 667-1331 List Price: \$2,603 In Short: The Series 01 would be almost per-

fect if it didn't get so noisy and so hot. It puts out a nearly perfect sine wave, and its voltage regulation is superb. CRCLE 883 ON PEACER SERVICE CARD

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■ BACKUP POWER



EDITOR'S CHOICE

Selecting a backup power system depends on what you want to protect and what you want to protect against. We've picked four favorites for four distinct sets of circumstances

Our favorite standby power supply that can be used with any PC other than a Zenith-equipped XT is Cuesta Systems Corp.'s DataSaver 400. Deceptively small, it is the most palatable for desktop use (it fits comfortably under a monitor), does double duty as a power distribution center, and will run an AT with both color and monochrome monitors attached.

For a Zenith-equipped XT, we'd choose American Power Conversion Corp.'s 450 AT+. It's compact and stylish, fast enough to keep the XT running, UL listed, and has power to spare.

If a true UPS is in order, we favor Imunelec's Micro-250 (now sold as the MS-300) for protecting most PCs. Compact and well made, it has the perfect capacity for a Zenith-equipped XT system. For heavy-duty use with large

systems, our choice is Clary Corp.'s OnGuard 600VA. It has sufficient capacity to run a network server with external hard disk(s) lone enough to bridge most outages or shut down the network in an orderly manner. Also, it's quiet enough for an office area and simple enough to use that it can be forgotten.

able. A button mutes the continuous warning beeper, which sounds whenever line voltage dips below 100 volts.

Two grounded AC receptacles are mounted on the rear panel. Three fuses protect you and the Series 01: one in the primary, one in the output, and one in the battery circuit. It is UL listed.

Winn L. Rosch is a contributing editor of PC Magazine.

Protection From Prying EYES



Software security programs for the PC hide and encrypt files and set up elaborate security systems for shared hard disk systems. Three of the four reviewed here even create a DOS shell and an e-mail system.

omputers are a security risk. Anything that can process and store information is a prime target for snooping and even sabotage. Back when the only computers were expensive mainframes, they were fairly safe for severin reasons. First, only a small priesthood understood them: not that many people knot their way around an IBM 360. Also, since computers were hideously expensive and needed year-ound air conditioning, the priesthood kept them in special, locked rooms with climate control. Even if you knew how to trash computerized data, you had a hard time getting to it. Finally, anything that got on the mainframe had to go through many hands and be seen by many eyes, and so the really juicy stuff stayed in the safe.

Personal computers have changed everything. PCs are everywhere, and an awful lot of people know how to use them.

They're cheap, and so no one locks them up at night. They're right on your desk, on and so you're tempted to put things on them that you might not want a key puncher to know about. Even worse, a lot of people share not only the same computer, but the same hard disk. Twenty megabytes of data storage suddenly seems less attractive when you realize you can't put anything on it you wouldn't want lots of folks to see. Fortunately, there is now plenty of see

HARD DISK PROTECTION

curity software for PCs, some of it specifically designed to protect data on a shared hard disk. If you have a multiuser system and are worried about security, one of the four programs reviewed here should meet your needs.

Of the four, my favorite is Frotee. It's inexpensive, easy to use, and does the job. Watchdog actually does more, but it is slow and complicated. HFTools for File! Directory Security has too long a name and too high a price. But it's the simplest of the four and works fine; if its manufacturer knocked \$300 off the price, it'd be a great buy. Finally, Kriights in onling more than a licensed version of Frotee in a nicer box and at a higher price.

NOW YOU SEE IT, NOW YOU DON'T All of these programs work by convincing DOS that what's on the disk isn't really there. Watchdog and Protec (and Knight) can convince DOS that an entire hard disk drive isn't really there. All four use fileand directory-hiding techniques that can't

can convince Dust mat an entire nature disk drive isn't really there. All four use fileand directory-hiding techniques that can't easily be picked apart with DEBUG or with utility programs. With these programs, you have to type in a password to get access to applications

in a password to get access to applications and data, a different approach from encryption programs, whose strategy is to turn flies into urreadable mush. Helding intermediate the strategy of the conception because in order to ecocyption passwords these programs have to store them somewhere on disk. Also, anything passwords these programs have to store them somewhere on disk. Also, anything can theoretically be taught to recognize, is can theoretically be taught to recognize, conceivably auster could get into your data without the password. So for added protection, these programs give you the option of encrypting files as well as hiding them. For enough, but such severes, they are safe enough.

All four programs are designed to be set up by a security manager who has special privileges in the system. He decides which user can access which parts of the disk, while retaining access himself to the whole system. The documentation for the programs is in two parts one for the manager and another for ordinary users. The manager's manual is much more detailed and tells how to set up and manage the security system.

All these systems are easy to use once

Sano Program	Program	Date	Start	End		Total			
	81/13/86	88:89	88:89		hrs				
SILL	1-2-3	84/13/86	88:12	88:12		hrs			
B111	Install	84/13/86	lllegal	Crosso	727	atte	opt.		
B111	Install	84/13/86	88:14	88:14		hrs			
Manager	Install	84/13/86	88114	88:19	98	hro	85	mln	
Manager	Install	84/13/86	88:19	88:38		hrs			
Fran	FinalWord	84/13/86	68:38	88:31	88	hrs	81	min	
Fran	DOS Commands	84/13/86	88:31	88:31	98	hre	86	mln	
Fran	Install	84/13/86		crosso	701	atte	Ρt		
749	Install	84/13/86	88:31	88:31	88	kes	88	min	
ren	EcM Mail	84/13/86	88:31	88:31	88	hrs	88	min	
Fran	File Utility	84/13/86	88:31	88:32	88	kre	81	min	
Len	1-2-3	84/13/86	88:32	88134	88	hes	82	min	
8111	1-2-3	84/13/86	88:34	88134	88	hre	88	min	
Len	1-2-3	84/13/86	88:35	88:35	66	hre	88	min	
B111	1-2-3	84/13/86	88:35	88:36	88	hrs	81	min	
dana szr	Install	84/13/86	88:37	88:37	88	hes	88	min	
Bill	1-2-3	84/13/86	lilegal	crosso	725	atte	Βŧ		
8111	1-2-3	84/13/86	lllegel	C10000	707	atte	ale.		
8111	1-2-3	84/13/86	86:37	88:41	88	hee	84	min	
Fran		84/13/86	Rad page	sword a	ttem	et.			

This example of a Protec unit audit report displayed on the screen shows the thorough yet simple manner in which the program traces attempts at unauthorized use of programs or files. Protec goes as far as telling what areas outside users tried to enter and for how long. "Illegal crossover attempt" means that a user tried to access data or programs that were off limits.

they're running. The trick is installing them. Except for HFTools, which is anazingly simple to set up, they all take some tinkering and figuring. Regular users needn't know anything about computers, but the security manager should.

PROTEC

Once it's installed, Sopheo's Protee is a complete DOS shell on your hard disk. Regular users need never see the C>prompt if the security manager doesn't want them to. If you boot from the hard disk, Protee takes over the boot sequence and forces you through its log-on and passion of the protein the protein of the protein the protein of the protein

Proter is a breeze if you're a regular user. The initial log-on screen lists the names of authorized users. You move the cursor to your name, type a user 1D (the program can be configured to skip this step) and password, and you then see a menu of applications to which you have access. You start a program how moving the cursor to its name and hitting Enter. When cursor to its name and hitting Enter. When more than the computer, you to get fire.

LOCKOUTS What you are allowed to do within the system is controlled by who you are as defined by your log-on ID and password. If you're an unimportant user, the security manager might have locked you out of all but one program—out of DOS, too. All you see is *Protec* menus and your applications program. The rest of the disk could be full of top secret information, but you have no way to find out. You



can't even do a DIR command.

As a more important user, you might have access to more programs, so that your applications menu would have more choices. You might also have access to a utility that lets you use TYPE, COPY, and DELETE but not other DOS commands. This utility, which works only in those directories you have access to, also lets you encrypt and decrypt files. Since you supply the password, what you encrypt cannot be decrypted by anyone else, not even the security manager. Encrypted files are the only parts of the Protec system the security

manager can't get into. If you're a still more important regular user, you might have data directories that belong to you alone. You'd use the same word processor or spreadsheet as other people but store your work in a directory that no other regular user can get into. If you have DOS privileges, you can run all the DOS utilities. However, you still don't have complete access to the disk. If there are directories that the security manager has locked you out of, you can't get into them even with DOS

SYSTEM BOSS The security manager, has the most rights and responsibilities. In this position, you decide whose names to put on the log-on screen, and you assign the log-on codes. You also assign initial passwords, but users can change them any time.

You can also set minimum password lengths so that users don't get by with easy-to-crack, single-letter passwords. You can go anywhere in the system with your own skeleton-key password, and, if a user forgets his password, you can log on for him and let him choose a new one.

If you like, you can make passwords "age," that is, ordain that after a certain period of time, they won't work any more. This feature doesn't lock people out of the system; it just forces them to change their passwords. That way, if a few users have told other people their passwords, the security breach won't last forever.

You also decide who gets access to which programs, utilities, and directories. Any user can go anywhere in the system unless you deliberately lock him out. You, as security manager, have access to virtually everything.

Finally, only you can examine the audit trail file. This is a record of who has logged

on and what programs have been used. This feature lets you create comprehensive reports of everything that has happened on the hard disk, or you can be more specific. If you sort the file by application, you can find out who has been using 1-2-3 or WordStar, say, and for how long. Or you can sort by user and find out everything your assistant did with the computer last week. You can also create violation re-

 All of these programs work by convincing DOS that what's on the disk isn't really there.

ports, which tell you who tried to guess passwords or get into areas for which he wasn't cleared. If users don't know that Protec has this capability, you'll quickly find out who the mischievous and curious people in your office are.

OTHER FEATURES Protec has a number of other features that you can use or ignore. One is electronic mail. Unless you specifically lock people out, all users have a mailbox and can send messages to any other valid user. If you're a user, when there is mail in your box, the system tells you when you log on. Only you and the security manager can read your mail. You can send messages to other individual users or to everyone at once, but they can consist of no more than one screenful. Also, you have to type messages in via a primitive screen editor, you can't send files you wrote off-line or save messages to disk. As the manual points out, the e-mail facility is more like an informal bulletin board.

Another feature is Nocopy. The security manager can install a special driver in the CONFIG. SYS file to make it impossible to copy anything out of specified directories. This is a good way to prevent employees from pirating software.

curity, you can set up Protec so that it encrypts files as it writes them. They are never on disk as plain text; they have to be decrypted automatically when they are read. Setting up this feature requires some sophistication and patience, and unfortunately the manual's explanation is not as clear as it is for other functions. However, once it's running, encryption-on-the-fly works with either floppy disks or the hard disk. It would probably be most useful if you had to keep data on floppies, which aren't under Protec's wing the way the hard disk is

Except for automatic encryption. Protec is easy to install. The installation menus are well organized and the security manager's manual is usually clear. Protec also makes it easy to change things later. The security manager just logs on normally and chooses Installation from the menu. Also, Protec doesn't require that you

do anything special to protect programs or directories you had on your hard disk before you bought Protec. You install Protec over them and it protects them. This ability is especially convenient if you use copyprotected programs that you had to put on the hard disk with some kind of fancy procedure. You don't have to touch them; just tell Protec they're there, and it will take care of them.

Protec seems quite secure, but it has some unintended vulnerabilities. If, for example, a regular user with access to DOS uses the TREE command, he will at least learn the names of which directories he is locked out of. He won't see anything in those directories, but he will get a glimpse of something the system doesn't want him

Also, some applications programs that let you write and read files with full pathnames may let users snoop. With my word processor, for example, I could read the file names in a data directory I had locked myself out of and could even write to that directory. However, I couldn't read files from it into the editor, nor could I destroy files by writing over them.

Unexpected access is mildly unnerving, but at least I managed this slight breach of security from within the system as a valid user, not from outside.

Protec is an excellent program and will If you're really worried about data seprobably do a good job for most users.

KNIGHT

So far as I can tell, AST made only one change when it bought Protec and called it Knight. You can write your own AU-TOEXEC.BAT files with both programs, and both will execute them before you see the log-on screen. However, Knight turns off the keyboard while the AUTOEXEC runs. Thus, if you have the DATE command in an AUTOEXEC file, Knight will hang up completely. Since the keyboard is dead, you can't enter the date. You can't do a warm boot either

You have to power down, boot from a floopy, and fiddle with the installation program before you can get to the hard disk and get rid of DATE.

The AST people claim that this feature prevents you from aborting the AU-TOEXEC routine and getting to DOS before Knight does. However, if you interrupt a Protec AUTOEXEC, it automatically kicks you into its log-on screen with no loss of security. AST must really want you to buy a calendar card.

WATCHDOG

Watchdog and Protec have been rivals since the two programs first came out about 3 years ago. They are both DOS shells and offer a lot of features and security. Like Protec, Watchdog interrupts the boot sequence and interposes itself between users and DOS. According to who you sign on as, it gives varying access to programs and data.

In general, Watchdog is the less friendly program and takes a fiercer attitude toward security. With Protec, you have access to everything you're not locked out of, but with Watchdog, it's the oppositeyou have to have specific permission to do anything.

Also, although the security manager can override it, Watchdog's default mode of operation is automatic encryption.

Watchdog is also a more elaborate program with more security options. You can do more than give a user access to a directory or not. You can set up his "user profile" so that he can read files but not write them, write new files but not read old ones, or read and write but not delete files. You have these options in all directories, or



A Watchdog menu that gives access to three applications areas and displays a function key map. Watchdog has more elaborate security options than Protec to allow users access to a directory or not. Also, Watchdog can print reports on outside users.

areas," as Watchdog calls them. Another ontion lets you give users access to selected DOS commands only if they give the right password. CHKDSK and TREE could have different passwords, for example, and they could be the only DOS commands a user could use. Also, you can let people edit the CON-FIG SYS and AUTOEXEC BAT files only if they produce the right password.

BARKS Watchdog is big on passwords, and unlike Protec, makes the security manager assign them all. Since he can't possibly remember them and the program doesn't include a "skeleton key," he must keep a list, which he has to store in some presumably secure place. Since it's easy to lose track of who has permission to do what and whether an area lets each user do what he needs to do, the security manager can print reports on passwords, user IDs, permissions, and so on. You wouldn't need these reports with the simpler Protec

system; you'd better keep them in the safe. Watchdog has much more elaborate ways to sort and display audit file information if you need to know who used the system or tried to snoop. You can set up customized report formats for one-shot printouts or save the formats for future use. However, to look at the audit file, the secu-



In Short: This DOS shell offers plenty of

features and security options, such as auto-

matic encryption, advanced e-mail, and re-

ports on passwords. Difficult to install and modify Copy protected.

The Second-Fastest Backup

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Back-It can prevent unintentional loss of data by sensing whether your diskettes already contain files. Back-It is the only program that allows you to enter any DOS command during the backup. You could,

command during the backup. You coul for example, run "CHKDSK" or "DIR A:" or another program without interupting.

the backup process!

COMPATIBILITY

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HARD DISK PROTECTION

rity manager has to go through a cumbersome, two-floppy procedure.

Watchdog's electronic mail system is more advanced than Protec's. You can write messages off-line with a word processor and then load them into e-mail. You can forward messages to other users or store them on disk

Like Protec. Watchdoo lets you establish directories from which users can't make illegal copies out to a floppy. Everyone who needed to use the program would have access to it, but no one could copy it.

BITES Watchdog does a lot, but it's not easy to install or modify. If you are the security manager, you have to use a floppy every time you make a change to the system. Since there are lots of options, some of them confusing, you'll be using that floppy quite a bit. Moreover, the installation and modification routines run slowly. and so every time you make a mistake and go back, you twiddle your thumbs while the disks grind and lights blink.

Furthermore, in order to run programs from within Watchdog, you have to install them with Watchdog. That's tricky enough for clean programs that aren't copy protected, let alone for anything that has an involved installation routine. The manual isn't at all clear on this procedure.

In fact, the manual is seldom clear. Installation instructions begin way back on page 134. To get the program going, you have to read several different parts of the manual, not necessarily in front-to-back order. I had to call the maker. Fischer Innis Systems Corp., to get out of one installation tangle I got myself into. The 800 number was busy only about half the time.

Once Watchdog is on guard, it's just as easy to use as Protec, and functions like automatic encryption go on very nicely in the background. However, since the DOS shell isn't as snappy as Protec's, you wait longer to switch applications. Also, the email system, though good, doesn't use the same commands as the other menus. This irksome inconsistency just adds to the program's slightly rough-edged feel.

NO TRESPASSING I was never able to open up even a crack in Watchdog's security. When I used a path-specifying word processor to try to look at files in an off-



An HFTools display of the directory C.\FData, which demonstrates the combination of the pro gram's simplicity and ease of use. Users can immediately find out which files are locked and which are unlocked. "SECURE" is indicated with an asterisk to show that it is actually a subdirectory, which is also locked. HFTools owes its simplicity to the fact that it is not a DOS shell and lacks many of the convenient features found in Protec and Watchdog.

limits directory, Watchdog kicked me out of the program and my text right out of Compared with the others, HFTools for

RAM. That's a brutal way to teach people not to trespass, although I'm sure it's effective. I have another beef with Watchdog.

Protec comes with a nice deinstallation utility that clears the program off your disk without a trace. Watchdog left hidden files here and there, including a hidden AU-TOEXEC.BAT file that I couldn't write over with normal DOS commands. There were also hidden files in all the directories I made with Watchdog; I couldn't empty

and delete them either. According to Fischer Innis, there are ways to avoid these problems, but they're not explained in the manual. The company promises an updated, improved Watchdog very soon. (Editor's note: At press time, Fischer Innis Systems released Watchdog 4. I. The System Administration Program, including the Audit Trail file can load onto and operate from the hard disk; outside directories may be brought under Watchdog with a keystroke; passwords and their minimum lengths can be controlled. The audit trail monitors DOS commands on the Utility Selection

HFTOOLS

File/Directory Security is breathtakingly simple. The installation guide is only 23 pages long (the other program manuals begin at 200 pages). But that's all you need. since HFTools is capable of only a few vital security functions.

HFTools is not a DOS shell. It lacks e-



II.	Protec* \$195	Watchdog \$295	HFToois \$350
Maximum number of users	52	No limit	40
Space needed on disk	320K	300K	55K
Copy protected	No	Yes	No
800-number phone support	No	Yes	No
Automatic encryption	Optional	Optional	No
Encryption scheme(s)	DES ¹ -based propnetary	Proprietary	Proprietary
Number of program disks	1	3	1
Protects programs already on disk	Yes	No	Yes
Area (applications) passwords	No	Optional	No
Automatic tog-off it unattended	Yes	Optional	No
Sorts audit tile by:	User, program, date, violations	User, area pro- gram, project ID, date, violations	(No audit file)
Prevents copying of programs on disk	Yes	Yes	No
Encrypts individual tiles	Yes	No	Yes

mail, audif files, automatic encryption, restricted DOS scess, or any of that fancy stuff. It's simply a small utility that hides files or directories from DOS. When you want to work with them, you use the same utility to find them, HFTool calls this locking and unlocking. The program optimes are very much like encryption utilities, except that it is for multiple users and operates on directories as well as file.

HFTook has two simple and basic rules governing its use (1) Anyone can lock anything that's not locked, but you can more lock only something that you lock off your control of the control

The program itself is nothing more than

the key for all this locking and unlocking. The key works differently for each user because he logs on with a different user ID and password. The program takes up only 55K bytes of disk space so that you can run it as easily from a floppy disk as from a hard disk. It will lock and unlock files or directories on any drive in the system.

When you run the program and log on, HFTools gives you a menu of what's on the disk. You move from directory to directory, and the program lists files that are unlocked and those that you locked.

HFTools doesn't bother to show you anything that someone else locked since you couldn't unlock it anyway. If you need to work with a file or directory that you locked, just hit a function key, and HFTools unlocks it. You then exit the program and do your work. When you're done, run HFTools again and lock everything back up.

HFTools has one user option. Instead of just hiding files from DOS, you can also encrypt them. When you unlock, HFTools

automatically decrypts. The encryption key is part of the program, you don't know it, nor do you need to know it—consequently, you can never forget it. Encrypting takes longer than hiding, and the longer the file, the longer it takes.

When you're out in DOS and try a DIR command, all hidden files and directories show up on the screen as

[Locked . . HF.[

If you try to use TYPE on a locked file, you'll get a "File not found" message.

The configured HFTools program is not protected on your disk in any way. Somebody could delete it anytime, and you wouldn't have the key to unlock anything. No problem. Just keep a backup of the configured program or take 3 minutes to install it again.

Of course, all the user IDs, the passwords, and the encryption key are in little 55K-byte file somewhere. What's more, there's nothing to stop you from copying it onto a floppy, taking it home, and studying it a your leisure. It's surely the easiest scheme of the four to break, I looked through it with DEBUG to looked through it with DEBUG to could find nothing that looked like passwords, even though I knew what to look for. HTOols is a slick, simple utility that

could do a lot of people a lot of good if it weren't so damn expensive.

Jared Taylor is a contributing editor of PC Magazine.



Pitted against Watchlog, HTTools, and Knight, Protec, Version 3.0, Sopheo Inc., emerged as the clear winner. Protec several high points for such features as electronic mail, saver rull file, and ransimum pass wersion of Protec, Knight tidd nor measure up to the standards of its ancestor because it installs various annoying features such as a keyband that turns off before booting can occur.

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FAST, FASTER, FASTEST: 9,600-BPS Modems Arrive

Yes, prices are dropping and speeds are climbing, but only identical modems can talk to each other. Until a 9,600-bps standard emerges, these high-speed modems won't be quite ready for prime time.

The byond the 1,200-bit-per-second modern standard and faster even than 2,400-bps are moderns that claim speeds of more than 9,600 bps. They have been around for some time for mainframes, but only for synchronous communications and at prices most PC owners would consider reasonable only for their next cars.

The new crop of high-speed modems attach to the serial port of a PC and can use standard asynchronous communications software. They are Hayes compatible, and prices range from just under \$52,400. Admittedly, they don't qualify as impulse buys, but, at the low end, these prices are affordable.

Not all the news is so positive. When PC Magazine evaluated modems from four different manufacturers, no two were capable of talking to one another at high speeds because the protocols were incompatible. These modems transfer information so fast—sometimes at more than 1,000 characters per second—that even the slightest noise on the telephone line can do major damage even to a text file.

The simplest solution is to build errorcorrection protocols into the modems themselves. Typically, each manufacturer has invented its own protocol for that purpose. And, as you might expect, even two more same communications protocols can't talk to each other unless they have the same error-correcting protocols. The result is the usual confusion of incompatible products. And while the market forces will eventually define a standard, in the meantime, the only way two different moders can talk to each other is to fall back to 2.400 or 1.200 bps. None-theless, if you need to transfer large amounts of information between specific floations. You can cut down long-distance locations, and the control of th

THE SPEED RANKINGS Speed is a complicated issue because the test results appear to be contradictory, making it impossible to single out one modern as the fastest. I timed Digital Communications Associates' Fastlink at a low of 8,225 bps and a high of 11,775 bps. Using the same files, the Microcom AXV9C4e measured a low of 7,625 bps and a high of 13,775 bps—making it both 600 bps slower than the Fastlink and 2,000 bps faster. To understand the test results, see the sidebar "Clocking the High-Speed Modems."

Based strictly on speed, the four modems reviewed here fall neatly in two categories: high end and low end. At the high end are the Fastlink and the Microcom AX/9624c. At the low end are the Racalvadic 9600VP and the EVI UPTA 96.

Both the Racal-Vadic and the EVI are straightforward 9,600-bps moderns. Both are based on the same communications protocol (V.29), and if they weren't using different error-correction schemes, they could probably talk to each other. Not surings on all the speed tests. The differences between them are presumably based on differences in their error-correction schemes.

The Microcom AX/9624c is similar to the first two, with one difference. In addition to its on-board error-correction firmware, the AX/9624c uses an on-board data-compression scheme. The technique will generally work better with text files than with command files, and it will work better with some text files than with others.

In one series of tests, the throughput for three text files on the AX/9624c varied between 14,700 bps and 17,400 bps, while a binary file managed only 11,250 bps. The modern did significantly better than 9,600 bps in every case, but the difference between 11,250 and 17,400 is nearly a 55-percent increase.

percent increase. Because Facilital gets its speech by using a significantly different approach to come a significantly different approach to come a significant of the significant of t

and Up," PC Magazine, Volume 4 Number 25.)

In the tests, the AX/9624e beat out the Fastlink more often than not. That gives it an arguable first place, but only barely. The Racal-Vadie 9600VP and the EVI UPTA 96 are tied for a distant third. Don't automatically rule these "low-end" moderns out, however. They're still faster than 1,200-bps or 2,400-bps moderns, and they're cheaper than the two high-end mo-

UP AND RUNNING Setting up and using any of these high-speed modems is little different from setting up and using any other Hayes-compatible modem. In each case, the back panel includes connectors

■ In the tests, the AX/9624c beat out the Fastlink more often than not. That gives it an arguable first place, but only barely.

for the power cord, the phone line, and the computer. Connect all the cables and load your communications software and you're

ready to go.

The only place you're likely to run into problems is in setting DIP switches or the equivalent software controls. But that's the case with most moderns.

can be a model of the company of the

original AT command set, then adds a few commands of its own. This means it may or may not work with any given software, depending on what features the software expects to control.

In running the speed tests, I gave commands both through Frosstalk and directly from the keyboard, and nothing notable happened. If you're familiar with the Hayes commands, you already know how to use three of these modems, and can manage with the fourth.

Microcom AX/9624c

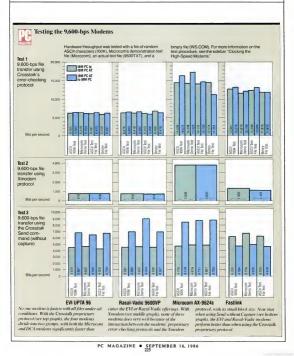
ASJ.799, the Microcom AXJ9624c is not, he most expensive modem in this group, but as 1 Vea already pointed out, it is marginally the fasters. The AXJ9624c is about twice the height of the typical external modern in the PC market and is slightly longer and wider to boot. Compared with most moderns in the date; processing market, though, it is sleek and slim. The black cast grain and spith design have the same flavor as some of the higher-power analyses can be supplied to the control of the processing regime under the hoof has been coupled up to run as fast as 19.200 box.

Microcom uses a two-step technique to boost the modem to the higher speed. First, it divorces the computer-to-modem link from the modem-to-modem link. Then it uses the data compression scheme to send the information over the phone lines.

Nearly all modems at 2,400 bps and slower are designed so that every step in the chain from computer to modem to modem to computer must be set at the same speed. The AX/9624c is smarter than that. It can talk to the computer at up to 19,200 bps while it talks to the other modem at 9,600 bns.

When sending data, this scheme lets the AX/9624c get information from the computer faster than it can send it over the phone lines. The computer has to start and stop the information flow repeatedly (under either hardware or software control of the modern), but the modern never has to wait for the computer.

The data compression feature, meanwhile, does its best to let the modern keep up with the computer. As the AX/9624c



9.600-BPS MODEMS



The Editor's Choice Microcom AX/9624c is price/performance leader among 9,600 bit-persecond moderns reviewed here.

gets the data, the on-board firmware encodes it, then sends the compressed data down the phone lines. On the other side, the receiving modem reconverts the incoming data and sends it to the computer.

DUPLEX AND ECHOPLEX SET-TIVOS The computer-to-moder link on the AX962bc differs from the modern-tomodern link in other ways besides speed. The computer and modern talk to each otheer using full-duplex, meaning information flows in both directions at the same time. But the moderns talk to each other using half-duplex, meaning that information flows only in one direction at a time. A short direction here to avoid confi-

sion: "full-duplex," is widely thought to be synonymous with "clooplex, it is not. With echoplex, or remote echo, anything you send to the remote system is echoed back to you. If the character that shows up on your screen is the one you typed, you know it was received correctly at the other end. If the remote system does not use echoplex, you won't see anything on your screen is the company of the character to the screen. This feature tells you won't see anything on your sould be sometimed to the characters to the screen.) This feature tells you conting about how well the other size received the data, but it lets you see what you type as you type it, you so you know you are you say you got any you are you would not have been also will not have been also will be you seen what you type as you type it.

Almost all communications programs refer to a remote echo as full-duplex and to

a local echo as half-duplex. In reality, the duplex setting and echoplex setting are independent of each other.

If your modern uses a full-duplex protool, as with the standard 1,200-bps. Bell 212 modern, then all communications are full-duplex, whether you're using local echo or remote echo. And if he modern uses a half-duplex protocol, as with the AX/9624c, then all communications are half-duplex—but you can set your software to local echo or remote echo or remote echo or remote exhorters.

For interactive communications, a halfduplex link can be cumbersome to use with remote cetho. Since the moderns can't send and receive at the same time, the receiving modern can't echo the characters until the transmitting modern stops sending. If you're a moderately fast typist, you can easily get ahead of your streen. And on the receiving side, you can't type anything until the other side stops sending.

In testing the AK/9624c with remote cho using Crossalt XVI, I saw no evidence of the half-duplex link. If you type at the keyboard while the modern is accepting incoming information, the AK/9624c buffers the outgoing data in memory until the remote modern stops sending. Even better, a fast "turnaround" time lets the modern quickly alternate between sending and receiving.

The result, says Microcom, is that the AX/9624c emulates a full-duplex modern. What that translates into in practice is that it's hard to distinguish half-duplex on the AX/9624e from full-duplex on a standard 1,200-bps modern. Aside from the increased speed, you're just not likely to notice a difference.

OTHER FEATURES The front panel on the AXV9624c includes seven satus lights. Five of these are simple onloff lights power on, off hook (indicates the modern has picked up the phone), data-terminal ready (indicates the computer land ready), intansmit data (blinks when sending data), and receive data (blinks when receiving data).

A test light flashes when the modem is correcting a communications error or when it detects a data error during diagnostics, and it remains lit if the modem detects a system error.

The last light indicates communications speed. The one light uses various combinations of colors and blinking speeds to signify 300 bps, 1,200 bps, 2,400 bps, 4,800 bps, and 9,600 bps.

As the various speeds suggest, the AX9624c can talk to other modems using the Bell 103 protocol (300 bps), Bell 212 protocol (1,200 bps), and V. 22 bis protocol (2,400 bps), It can also use the European V. 22 standard at 1,200 bps. The 4,800-bps speed uses the proprietary protocol and is meant for phone lines that are too noisy to handle 9,600 bns.

In addition to the status lights, the front panel has two switches. One of these switches between synchronous and asyn-



chronous mode. The other is the talk/data switch, which provides a simple way to switch between modem and phone during a call.

GETTING STARTED The AX/9624c comes with Microcom's all-purpose, book-size manual for the Microcom AX series, plus a 17-page addendum covering the specifics of the AX/96 modems.

Fortunately, the manual is written for those who would like to use the modern rather than read the book. The first chapter gets you off to a good start. It includes a useful note on how to choose between the AT command set and Microcom's own SX mode ("'If you are using a personal computer running Hayes-compatible software

. . . choose AT mode''). It then lists which chapters to read, depending on the mode you've chosen.

With AT mode, a single chapter will go you started. It gives instructions for installing and using Crosstath XVI, PC Tatk. III, and Microcom's own Era2 Stand Alone software for the AX modem. If you're using some other software, you'll have to translate these comments for your period of the province of the province of the province in communications, this shouldn't be a robblem.

Fastlink

If you're looking for top speed and never mind the cost, the Fastlink, from Digital Communications Associates, is very much in the running. Think of it as the Mercedes alternative to the Microcom Porsche. This is the second time I have reviewed Fastlink





Digital Communications Associates' (DCA) already impressive and recently improved Fastlink comes in both an internal and external version.

(see "Fastlink: Communicating at 10,000 bps and Up," PC Magazine, Volume 4 Number 25). Much of the original review still applies, but DCA has changed the firmware to improve performance—particularly the speed. Already an impressive product, the Fastlink has enough new features to earn another look.

The Fastlink still comes in two versions—a \$2,395 external modern and a \$1,995 board modern for the PC, XT, or AT. For this test, DCA provided two external moderns, but my previous experience is that the two versions have only minor differences.

Physically, the Fastlink is unchanged. Measuring 8½ inches wide by 2 inches high by 12½ inches deep, it is far too big to fit comfortably under a desk phone or to share the top of a system unit with a monitor. It has an attractive modern design that puts most other modems to shame.

The front-panel status lights on the Fastlink are much the same as on the AX/9624c. They include a modem-ready light, a terminal-ready light, a off-hook light, a receive-data light, a send-data light, and a pair of lights to indicate the speed of transmission.

The Fastlink can handle a variety of modern protocols. When I first reviewed the Fastlink, these included Bell 103 (300 bps), Bell 212 (1,200 bps), and DCA's own high-speed protocol. Newly added

are V.22 (1,200-bps European standard) and V.22 bis (2,400 bps).

MORE POWER Fastlink's proprietary communications protocol differs dramatically from the protocol used by the Microcom modem (and from most other modems). But one feature it shares is the ability to talk to the computer at a different

speed than it uses with the other modern. Typically, the computer is set to talk to the Fastlink at 19.200 bps. The Fastlinks establish their own speed and vary it in 100-bps increments, depending on the quality of the obnoe line.

DCA has significantly boosted the speed of the proprietary protocol. As originally released, the Fastlink had a maximum claimed speed of up to 15,000 bps, with a claimed throughput of 10,000 bps.

The new Fastlink will still talk to the original version, but DCA now claims a maximum instantaneous speed of 18,000 bps and a throughput of 14,000 bps.

The new version of the Fastlink easily outperforms the old, though not quite as much as these numbers suggest. One example: a 100K file that took 2 minutes to transfer with the old Fastlink took only 1½ minutes with the new version.

Another significant difference in the new Fastlink is the way it handles remote echo. The Fastlink communications protocol sends data in packets rather than keystroke by keystroke, which means the remote computer can't echo any of the characters until it has received the entire packet.

In the original version of Fastlink, this was a significant problem. As I pointed out in my review, it was easy to get several words ahead of the screen while typing, making interactive communications uncessarily clumsy. In the new Fastlink, the problem has all but disappeared. It's still possible to get ahead of the screen, but unless you are an unusually fast thinker and a demon typist to boot, it's not likely to be a serious problem.

More interesting than the improvement istelf is the promise of more to come, with the ability to upgrade at minimal cost. The only physical difference between the original Fastlink modern and the new version is a change of four chips. If you have the original Fastlink, you can have DCA put the chips in for \$250, or you can buy them for \$99 and nut them in yourself.

When I first reviewed the Fastlink, a DCA spokesman told me that such upgrades were possible, and I filed it under "we'll see." Now that it's an accomplished fact, I'm wondering what will come next. Start tuned for developments.

Racal-Vadic 9600VP

Racal-Vadic has long been a major manufacturer of modems for the data-processing market. Recently, the company has been trying to find a place in the PC market. The Racal-Vadic 9600VP, which can take its orders from either Racal-Vadic's own command set or the Hayes command set, is one more step in that direction.

If the Fastlink is a Mercedes and the Microcom AX/9624c a Porsche, then the Racal-Vadic 9600VP is unquestionably a Chevy. You'll find nothing too flashly here, or blindingly fast, but you will find a full-function product that offers more than minimal capabilities.

The 960VP is available in an external version only. For those who like to know what's going on with their systems, the modern offers roughly twice as many status lights as the other moderns reviewed here. One bank of lights includes power on, data-set ready (similar to off hook), data-terminal ready, transmit data, received

CLOCKING THE HIGH-SPEED MODEMS

The speed results for the four high-speed modems varied a lot depending on what files they were sending and what computers they were attached to.

Deciding what tests to run on the moderns was complex because of the number of variables involved. At the very least, the system throughput cheepeds on some combination of the time that takes your software to coordinate with the other system; the clock speed of the transmitting computer, disk-access time in reading the file; quality of the phone limit; the clock speed of the metamoriting computer, and access time in writing the file to disk at the receiving end.

Other possible factors include screenupdate speed when sending text files as text and the amount of RAM available on the receiving side for storing the incoming file (more RAM means storing larger chunks of data before writing to disk and therefore means fewer disk accesses).

Almost locidental to all this is the speed of the modern itself and the amount not of "overhead" involved in the modern's scheme. Modern manifacturers base their figures on the time it takes to move information modern to modern, without worrying about the complicating factors. This method gives a pure region of modern speed, but it doesn't reflect the system throughout vou'll see.

The speed tests measure total throughput for communications between typical systems. This way, they give a realistic sense of the practical benefits of each modern.

HARDWARE To get the best speech a modem should be hooked up, on both sides of the link, to a Compaq 286 or any machine with a higher-than-normal clock speed. What's more, the computer should be reading files from and writing files to a RAMidsk rather than a real disk. To get the worst speeds, the modem should be hooked up to floppy-based PCs using the floppy disks.

The systems used in all tests were an MPC with 512K RAM and a color display on one side, and an IBM AT with 640K RAM and a monochrome screen on the other. Both ran DOS 3.0, using the DOS-supplied VDISK. All files were sent in both directions on these machines, often with significant differences.

SOFTWARE All tests were run with Crosstalk on both systems. I chose CrossTalk partly because it's a popular program and partly because it is one of the few programs that can work well with all of these high-speed modems.

One not-so-obvious problem with including an emre-correction protocol in the modern itself is that the modern will often not work efficiently with software of that also includes an error-correction protocol in its file transfer option. The two vortices not only do double work; they are an actually interfere with each other so so that the throughput of the system drops dramatically.

To prove that point, I transferred one file with each modern using Crosstatk and the Xmodern protocol. Two of the moderns managed a throughput of less than 900 bps. The best speed in the batch was 3,825 bps for the Microcom AXY9624c. While this is a respectable speed, it is still lower than any other modern in any other test.

Crosstalk, Version 3.6, and Crosstalk-Fast, Version 3.5, both let you adjust block size on the Crosstalk protocol so that it won't interfere with the modern. They also let you set the computer for 19,200 bps. And although there are slight differences between the two versions of the program, they are similar enough to provide a consistent test for all of the moderns. PHONE LINES The most important variable in effective file transfer is the quality of the phone lines. Noise leads to errors, which mean resending parts of the file and slowing down the overall file transfer rate. The tests short-circuited his problem by connecting the moderns back to back with a standard modular phone cable.

The best connection ensures consistency on all the speed tests, it doesn't show what happens over normal phocories. For example, with most error, rection schemes, if the receiving modern detects an error, the transmitting modern has to resend all blocks from that error conward. React-Vadic says that of the four moderns reviewed here, its modern is the only one that can electively resend in the only one that can electively nested to the converse of the conference of the confer

DCA's Fastlink takes advantage of the wide bandwidth on local phone lines to get some of its high speed. But longdistance lines have a smaller bandwidth that gives the Fastlink less to play with and slows down the modem.

On the other hand, on noisy phone lines, the Fastlink can adjust itself in increments of less than 100 bps at a time, a design that lets the modern find the fastest usable speed, where the other modems have to drop down to 7,200 bps or 4,800 bps.

MACHINE-DEPENDENT RESULTS In addition to testing the modems with the Xmodem protocol and the Crosstalk

the Xmodem protocol and the Crosstalk proprietary protocol, the speed tests also timed file transfer with the Crosstalk Send command. This feature sends the file just as if it were typed at the keyboard. The text goes to the screen on the receiving computer and may be captured to disk or not, depending on how the receiving system is set up. I timed it without caputing the text to disk.

The tests turned up some interesting results. With the Microcom and DCA modems, the Crosstalk proprietary protocol always gave the fastest file transfers. With the Racal-Vadic and EVI modems, the Crosstalk protocol was faster

when going from AT to PC, but using Send was faster for going from PC to AT.

Out of curiosity I also tried the Racal-Vadic and EVI modems with Capture on. Even then, transferring the files on these modems from AT to FC was faster with Send than with the Crosstall protocol. If both systems had had monochrome monitors, Send might have been faster in both directions. Test your system to find out the best approach to file transfer.

For testing the Send command, I timed three different text files, including one supplied by Microcom to show off its data-compression technique. For the Crosstalk proprietary file transfer, I added a binary file as well. The results in each case give a range of throughput speeds. That range is more significant than the individual measurements.

WHAT WAS MEASURED When looking at the results of the speed tests, teep in mind that these tests measure the hardware throughput, not the system throughput. There is an important difference between the two.

System throughput measures the average speed between the time you give your software the command to start and the time you get back control over your computer.

Hardware throughput measures the speed between the time the sending computer starts sending and the time the receiving computer acknowledges the end of the file.

The Crosstalk proprietary protocol, for example, usually takes 6 or 7 seconds to start the file transfer and typically waits 2 or 3 seconds after announcing the transfer is over before giving up control of the keyboard. The system throughput speed would count those 8 or 10 seconds as part of the file transfer. The hardware throughput does not.

I've confined myself to hardware throughput speeds because they give a better measure of the actual modem speed, but remember that the system throughput—and the amount of time you have to wait—may be longer.

-M. David Stone

data, carrier detect (indicates the 9600VP is talking to another modern), ring indicator (lights when the phone rings), clear to send (the modern is on and ready), speed, and error control (indicates when the error-crection protocol is active and when the

modern has detected an error).

Seven other lights are associated with front-panel switches and indicate settings for synchronous-versus-asynchronous communications, voice versus data, speed setting, and various self-test features.

sensing, and various served retainers. With all these status lights, it is unformate that the lights face up rather than forward, to that to see them you have to put word, to that to see them you have to put place its on your desk, but at 8 inches wide, place is on your desk, but at 8 inches wide, but you will have been a seen and the seen and the seen and the seen as the see

COMMUNICATIONS FEATURES As the status lights for speed suggest, the 9600VP can use a variety of modern protocols. The modern is not as versatile as the AX79624c or Pastlink, however. Aside from its own protocol, it's limited to Bell 103 (300 bps) and Bell 212 (1,200 bps). Notable for its absence is the V.22 bis prococol for communications at 2,400 bps.

Many of the 9600VP's features are irrelevant for the PC user. The front-panel controls and on board telephone book are useful if the modern is connected to a terminal but are pointless if you're control-



9.600-BPS MODEMS

_	
PP	9,600-bps Modems

s: Summary of Features

Product/ Manufacturer	List price	Command sets apported	top speed w' proprietary protocol	speeds w proprietery professi	Async modes	No. of status lights	Competible w Bell 163 and Bell 212	Compatible w.Y.22 at 1,200 bps	Compatible w V 22 bis of 2,400 bps	Synchronous operation	On will switch	Freet- posei santrois	per switch settings
EVI UPTA 96 Electronic Vaults Inc	External, \$995 Internal, \$895	Onginal AT, Expanded AT	9,600 bps	4,800 bps	Auto-dial Auto-answer Manual dial Manual answer	6					•		•
Racal-Vadic 9600VP Racal-Vadic	\$1,495	Expanded AT, Racal-Vadio	9,600 bps	7.200 bps 4,800 bps 2,400 bps	Auto-dial Auto-answer Manual dial Manual answer	9	•		-	•		•	
Micrecom AX 9624c Microcom Inc.	\$1,799	Expanded AT, Microcom AX	9,600 bps	4,800 bgs	Auto-dial Auto-answer Manual dial Manual answer	7	•	•	•	•		•	•
Fastlink Digital Communications Associates Inc.	External, \$2,395 Internal, \$1,995	Extended AT	18,000 bps instantaneous. 14,000 bps (hroughput	Increments of less Ihan 100 bps	Auto-dial Auto-answer Manual dial Manual answer	7	•	•	•	•	•		

ling the modern through software.

According to the 9600VP manual, the modem will work at 9,600 bps with any AT-compatible software that can handle the speed. It gives no hints for specific programs, but a section entitled "Preparing to Use AT-Compatible Software" gives step-by-step instructions that will be easy to follow if you're familiar with your communications program.

The one serious flaw with the 9600VP is its price. Selling for \$1,495, it is only \$300 less than the Microcom AX/9624c. At first glance, that may seem like a big

enough price difference to justify buying a low-end rather than a high-end, highspeed modern but Microcom sells another high-end modem for \$1,599, the AX/9612.

Like the 9600VP, the AX/9612 lacks the V.22 bis protocol for 2.400-bps communications. But otherwise, the AX/9612 is identical to the AX/9624c. In particular, it uses the same protocols and data compression scheme to increase its throughout dramatically at 9,600 bps. When compared with the much faster AX/9612, at just \$100 more, the 9600VP is hard to justify-unless you are using a system that can't take advantage of the 19,200-bps modem-to-computer link.

EVI UPTA 96

The EVI UPTA 96, from Electronic Vaults, is priced at \$995 for the external version or \$895 for the half-card board modem

Of the modems tested for this article. it's the only one limited strictly to its proprietary high-speed protocol. If you already have a modern for lower speeds and can devote two serial ports to your modems, this may not be a consideration. But keep in mind that the combination of the UPTA 96 plus a second modern can easily



Despite its impressive status display panel, the Racal-Vadic 9600VP shown here is an adequate middle-of-the-road 9,600-bps modem.

FACT FILE

EVI UPTA 96 Electronic Vaults Inc.

12347-E Sunrise Valley Dr. Reston, VA 22091 (703) 620-3900 List Price: Internal, \$895; external; \$995 In Short: This low-budget, high-speed mo-

dem uses only its own proprietary protocol, but it's a reasonable alternative for those who want to keep costs down and already have a low-speed modern for com 1,200 bos and slower

CIRCLE 650 ON READER SERVICE CAR



■ 9,600-BPS MODEMS



The greatest virtue of the EVI UPTA 96 is price: at \$895, it's the cheapest 9,600-bps modem reviewed here. But caution, price can be deceiving.

put you in the same price range as the Racal-Vadic 9600VP and the Microcom AX/9612.

The UPTA 96 is the same height and depth as the Hayes Smartmodern and about an inch wider. If you already have an external modern, the UPTA 96 will fit comfortably underneath. It sports eight status lights: power on, terminal ready, send data, receive data, carrier detect, off hook, clear to send, and ring indicator.

The UPTA 96's enhanced subset of the Hayes command set didn't cause any problems during the speed tests, but be forewarned that with many communications



Of the units under review, the Microcom A. N962de the clear price/per/primance leader, with the highest measured throughput and only the second-highest price. DCA's Fastilink's measured throughput is nearly as high, and the company has proven its ability to upgrade with only an inexpensive change in firmware. For bar gainbasement entry into the high-speed area, the EVI UPTA'96, at under \$1,000, is the only choice. programs, you can't get away with installing the software for the Smartmodem. The UPTA 96 manual recommends specific versions of Crosstalk XVI, Relay Gold, Respond, Carbon Copy, Q-Modem, Blast, and Professional YAM.

Also be forewarmed that the UPTA 96 is clumsy for interactive communications. When you're typing at the keyboard, it's easy to get ahead of the screen when using remote echo. The solution, according to EVI, is to "use local echo whenever possible," but in some situations, switching to local echo is also awkward.

Despite its limitations, the EVI UPTA 96 is still worth a look—especially if you can't justify the cost of two Fastlink or AX/9624c modems. Editor's Note: At press time Electronic Vaults announced nine FASTCOMM models, which include every combination of standard modem protocol, both with and without the EVI 9,600-bps protocol. You can add protocols to whichever model you have with FAST-COMM's "Fast-Snap" boards. You could start with a 300/1,200-bps internal modem for \$395 and add a 9,600-bps upgrade later for \$525. Or start with a 9,600bos modem at \$895 for the internal version, and add 300/1,200- and 2,400-bps compatibility as needed.

M. David Stone is a frequent contributor to PC Magazine.

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CIRCLE 393 ON READER SERVICE CARD



Remote lets you run almost any program, from any location, as if you were there.

Remote is the software that turns your personal computer into a host computer. You or anyone you choose can dial it up from almost any terminal in almost any location, and run most popular application programs such as word processing, spreadsheets, and data base managers.

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APPLICATIONS: THE Smart

SOLUTION

perfect integrated program at times seems like the search for the clusive Holy Grail. These programs, while they combine the five most commonly used PC applications in one puckage that permits easy data interchange among them, usually achieve this integration at the expense of full functionality in one or more of the modules. In-novative Software's The

the search for the

Smart Software System comes closer than most to the ideal: its modules, while by no means flawless, can all respectably compete with good standalone products in their categories. What it sacrifices for its balanced performance is a certain measure of integration.

Like its chief competitors, Framework, I. Symphomy, and Enable (see "Integration with Integrity: Framework, Symphomy, and Enable; "PC Magazine. Volume 5 Number 11), Smart includes a word processor, a database manager, a spreadsheet, a graphics utility, and a telecommunications program. You can purchase Smart as a complete integrated set or as a separate

Innovative Software's Smart System offers an acceptable level of integration without sacrificing too much functionality within its individual applications. Its modules are respectable, even impressive, performers.

> word processor, database, or spreadsheet with graphics; either way, it includes telecommunications, time management, a programming language, a formula calculator (endowed with the entire set of spreadsheet functions), and a basic text editor, giving you most of the services of a desktop utilities program.

One way that Smart maintains its surprisingly consistent level of quality across all its modules is by sidestepping the dominance of one particular data structure; each of Smart's modules retains a distinctive flavor that makes the package seem more like a well-coordinated series of standalone packages than like traditionally homogeneous integrated software.

The price for this greater autonomy of the modules is occasional lapses in closeness of integration. Although you can create up to 50 windows, files simultaneously represented in different windows must be of a single type: thus while you can view multiple word processing documents simultaneously on-screen, you can't compare one with a database and a spreadsheet. You can transfer data between two word processing documents or two spreadsheets on-screen, but exchange of data between dissimilar applications or between two databases occurs in file-based transfers using Smart's proprietary data interchange formats. Fortunately, these transfers are relatively simple: you can easily put spreadsheet graphics or a database report into a word processing document, for example.

Like most integrated programs, Smarr is largely menu driven and includes an integral programming language that gives you access to the power of each of its modules. Five separate menus control each application—a design I found a bit awkward. The first three menus vary from one application to another, the fourth and fifth deal with file operations and system utilities.) However, the program allows you to vary the available range of commands among a

simplified set of menus appropriate for bepinners, a full range of menus for intermadiates and the forest for intermamode suitable for experts. Whatever the mode, a set of "Quick losys" is available for rapidly executing frequently used commands—generally function keys or Alt-CIT key combinations. A macro facility allows you to store any series of keystrokes unavailable through the Quick keys.

Other nice touches include 11 word processing fronts for you can display custom fonts through an internally toggled graphics mode) and room for two additional fonts you design (the program gives you design (the program gives you can be protected, in the case of spreadsheet lifes, the program employs passwords in order to distinguish between read and read/write access.

The windowing facility is helpful but rather limited. Windows tile beside one another without overlapping. And, while any window may be zoomed to full screen, you cannot adjust the size of an existing window without recreating it.

Like most other integrated programs, Smart is large; its need for numerous working files and its occasional use of overlays make a hard disk almost a must. I used one during my testing and my conclusions reflect that

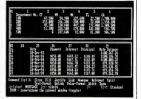
Spreadsheet

The Smart spreadsheet is remarkable for several reasons: its 9 999 rows by 999 columns and sparse-matrix memory management make it suitable for the big jobs most spreadsheet applications inevitably become, you can merge its graphics into word processing documents with text and graphics on the same line, and the scope of its native functions (119) offers ample formula-writing power. These things aside, it offers one other outstanding quality; superior recalculation speed. While parts of the program access overlay files, the formula processor remains entirely RAM resident. At an eye-popping elapsed time of 3 seconds in a test of recalculation speed, Smart rates "best of class" by nearly two to one over Symphony (5.5 seconds), three to one over Enable (10 seconds), and eight to one over Framework (19 seconds).

Although it employs a Multiplan-like "r1C12" cell identifier convention. Smarr's spreadsheet is otherwise modeled on the familiar 1-2-3 design. However, Smarr is not a 1-2-3 clone, and while the similarities are sufficient to make even tyde-in-the-wool 12-3 users comfortable, there are several significant differences (most of them advantageous).



The chief advantage of windows is that they ollow you to have alternative views of the same file or of another file within the same application, or even from another application of the file has been exported to the module you're working in. Window! In the serven or left shows on optional page break to solid, horizontal line it nous file, while Windows 2 and 3 show olternative views of a single mail merge file.



Word processing windows olso have the ability to hold footnotes. The sop window in the screen on the right shows o cross-tobulotion outomatically generated in the database and exponent to the spreadsheet with Smart's powerful Send Summar ited command. The bottom window holds o 1-2-3 (Release 1A) worksheet imported without troussloins; Smart can olso write 1-23 files. MULTIPLE FILES Smart's windowing capability lets you keep multiple windows open on the current spreadsheet or keep multiple files open in different windows and use formula references to the tem too gether. References to external worksheets are unaffected by recalculation status; the worksheet manually before it will update them, and all files involved in such references must be RAM resident. (Its support for the Lousd'Intel/Microsoft Expanded Memory Specification, the AST appers to if it, AT extended memory; and disk-paging capabilities enables you to use

numerous files should the need arise.) Since Swart's chalbase functions are part of its database module, you won't find so database module, you won't find to come the common state of the



The spreadsheet supports string references (the ability to return the string value of another cell through a cell reference) and a full range of string manipulation functions (such things as Mid. Right, Tenter automatically supplies a space (you don't have to write "First" &" "&"Last"); the more conventional form of that or return is available as with the reference of the order of the order is available as with the reference of the order is available as the second of the order of the order or is available as the second or the order of the order or is available as the second or the order of the order or is available as the second order or the order of the order or is available as the second or the order or the o

Formulas must be preceded with an equal sign; thereafter you may point to ranges as you would in 1-2-3 and substitute range names for cell addresses in formula and worksheet navigation commands. Range names are not quite the equal of 1-2-3's: I missed seeing a menu of available range names at the time of creation (Smart can show you such a menu but not

while you are creating a new name). The program supports date math and offers two convenient operators to convert textual data entries into cell entries that appear as dates and can be manipulated arithmetically with the program's date functions. For example, if you type an "at" (@) sign before you type "1-1-86" "1/1/86", "Jan 1, 1986", or "January 1, 1986", you will see "01-JAN-86" on the worksheet (multiple date formats are available). Another work saver is the Report command, through which you can store report settings, including numerous separate ranges (although some restrictions on ordering apply), include page breaks, and define multiple headers and footers.

GRAPHICS Smart's spreadsheet, more properly The Smart Spreadsheet with Graphics, comes with integral graphics consisting of line, bar, stacked bar, stepped line, x-y, pie, and high-low charts, and histograms. You can exercise selective control over fill patterns and colors, orient them vertically or horizontally, select from two- or three-dimensional formats, and use an editor to add special titles or annotate graphs. Smart can display and print graphs from within the spreadsheet and can store graph images for display without the corresponding spreadsheet file. The programming language lets you configure a slideshowlike presentation using such graphs. I had only one quibble: regraphing existing data was a bit slow because the program makes a disk access.

Database Manager

Like most relational database managers, Smarr's program is powerful and complex, but at times it is also downright cumbersome. Many users I spoke with named the database as the most difficult module to master. For example, to execute a sort you must define and store the sort definition in a file; assign an index file to this sort-destribition file; and then execute the Order command specifying the name of the index file.

file.

Smart allows you to define up to nine customs screens (in addition to its automatically generated default screen) with each specific properties of the properties of the specific properties of the structure, whereas screen passwords protected the structure, whereas screen passwords protection does not encrypt data files, you shouldn't view it as a way to prevent unau-

thorized snooping.

A nice range of data types includes alphanumeric, numeric (also includes calculated fields), date, time, social season and the state of the s

KEYS AND INDEXES. The program supports both keys and indexes, but those supports both keys and indexes, but those some part of the program of

■ THE SMART SOLUTION

```
Esployee Second laput Form
      Department ho. 289
      First Fare Stefan
      Last "igne Billeans
      Engliques Nurver 120019
      X:1 Salary 25100.00
                                Current Salary 19999.00
      Dange Yorth 18
                                 Start Torth 5
      Chance Day 18
                                 Start Is, 23
      Change (ear $2
                                 Start Gar #1
Command list 3: Border Clese Link Paint Split Bnlink Zeam
       FLAGY Unredout 2
liab windows to display matching informatio
```

Smart's Link command appears to merge two files on the screen. Two independent files, one containing personal information (top four lines) and the other a salary record, are linked in two separate windows. The window borders have been suppressed and the linking field hidden to create the illusion of a single file.

plicate key entries. Smart does not physi-[Sales] > 100 where [Region] = "Southcally sort your files; instead it uses onetime indexes (which cannot be updated). An Order command allows you to select from sequential, keyed, or indexed access to your file. However, indexes are also used to store predefined queries, and so you also must use the Order command to activate stored queries, a perplexing convention. Yet another anomaly: when you are presented with a menu for key selection, the program allows you to select un-Deleting any more than the current rekeyed fields, resulting in an error message

Although Smart's custom screen definition lets you position fields where you wish and enter your own prompts, titles, and line and box graphics, a lack of adequate editing tools hampers the process. There is no move command, and text will not close up over deleted characters: you must delete the whole line and begin again. Since you can access fields only in sequential order (there is no menu to permit random access), changing the physical order (and therefore, data entry order) of fields is a demanding task.

as soon as you execute the command.

OUERIES Unlike most Smart operations, which rely on menus, the query function depends heavily on formula writing, making it syntax dependent. Once you learn the syntax, it's straightforward:



Smart's custom screen-generation facility allows you to supply custom field prompts and other text, draw line or box graphics, designate fields "read only" or "must enter," and specify range checks. However, the program does not allow you to move existing entries or effectively edit text; the only remedy is to delete your text and start over.

west". The "where" operator used here functions like a Do-While statement; provided the file is in keyed order, speedier queries result. However, the query facility does not trap data-type mismatches; the resulting query merely fails to find the desired records. If you make a simple syntax error of this kind, when the program fails to find the records, you might wrongly conclude that they aren't in your file.

cord seems unneccesarily complex; you must query to separate the subset of records you wish to delete, write a formula to replace (mark) all such records as deleted. then purge them.

Smart's interactive menu offers some support to multiple-file operations. All data files involved in multifile operations must be open during those operations (although not all need occupy a window on the screen). The Link command enables you to tie two files together on the screen (but no more than two). By turning off the screen's borders and adjusting the window to hide the duplicate key on which they are linked, you can make the two files appear as one. A Lookup command will retrieve values from one file and insert them in another, and a powerful Transaction command will nest records in one file based on those in another, as well as leave behind an audit file to document its work.

The Relate command allows you to join two files based on union (all records), intersection (matching records), nonintersection (nonmatching records), and subtraction (records from a secondary file that do not match the primary file) conditions. However, inasmuch as Relate is a physical join of files, it is wasteful of disk storage and is not the ultimate answer to most multiple-file reporting requirements.

REPORTING Smart's report generator offers tabular and free-form reports, and a hybrid two-file report incorporating both formats. Unfortunately, most multiple-file reports won't be possible with this command. Its hybrid report is most suitable for something like an invoice, where you want the address section laid out in free format and the body in a tabular report. However, you cannot do what you are more likely to want: create a report using multiple files in table format or in free-form format. On the simpler side of reporting, it's also not easy to obtain a simple printed list resulting from a query. The procedure's complexity makes you appreciate the wonderful economy of dBASE's "to print" operator. which you can append to any query to obtain such reports.

Smart's database module imports and exports data freely. While it supports di-



To see any of Smart's 11 fonts (left), you select graphics mode from a menu. The rectangular block is a merged graph as it appears on the screen (note the graph filename, PIE.SCN). Smart automatically formats the text column to the left of the graph and reformats the text to fill available space if you delete the graph from the document. In

rect translation of only dBASE II and Innovative's T.I.M. program files, if you take a moment to define the file structure inside Smart, you'll be rewarded with rapid imports of either segential (comma-delimited) or fixed-length files. You can send data files to the spreadsheet as is or in summarized format. Smart really showed off its whiz-bang speed for this function: the program cross-tabulated a 500-record personnel file on five vertical and four horizontal dimensions, loaded the summary report into the spreadsheet, and automatically adjusted its column widths-in 20 seconds. That's performance. (Strangely, while you can send that report to a spreadsheet, the word processor, or to a file, you cannot di-

Word Processor

The Smart word processor announces itself with the blue logo for the Merriam-Webster Linguibase, the popular spelling checker also used by MultiMate and the Leading Edge Word Processor. The Webster dictionary allows you to spell-check any increment of text from one word to the entire document, and you can opt to have the results of a spelling check sent to a file if you don't want to sit through the correction session now.

rectly send it to the one place you would be most likely to want to send it: the printer.)



nongraphics mode (right), Smart represents the fonts in color. Of the five available command menus, command list 5 (shown at the bottom) is standard across all applications. Command list 4 deals with file-related operations, while menus I through 3 are application-specific.

 The entire process of merging a graph and a word processing document is about as tough as sharpening a pencil.

The program's mail-merge utility allows you to designate optional fields, and it automatically rejustifies text to suit the final length of each line. Graphs created and saved in Smart's spreadsheet can be inserted into a word processing document, sized (small, medium, or large), and justified to the left or right margin; but you lose the graph-editing capability offered in the spreadsheet. Smart automatically reformats margins to form a column for text beside an inserted graph. Should you later decide to remove the graph (a menu choice), Smart will again automatically reformat your document. The entire process of merging a graph and a word processing document is about as tough as sharpening a pencil.

Innovative Software supports the IBM Document Content Architecture data inter-

change format for file translation (both directions); a separate utility converts Word-Star files into Smart format (but not the reverse). Despite all these facilities for dealing with data from the outside world, the Smart word processor unfortunately cannot search and replace on carriage returns, leaving you the tedious task of manually removing the ones that normally occur at the end of every line in an imported

As in other modules, the word processor keeps you well informed. On-screen prompts display your page and line number, and you can scroll through several panels to view the entire assortment of Ouick keys and function-key assignments. That's useful because, although all modules have such keys, they seem to receive heavier use in keyboard-intensive word processing than in spreadsheet work. You can also keep tabs on available memory and free disk space and the current contents of the deleted buffer.

Although Smart's word processor is very full featured, operations that in Framework require one or two keystrokes sometimes take several more in Smart. The word processor reformats text automatically, but it does not do so continuously, and I found the brief lag between data entry and reformating to be disconcerting. Several times this protocol engaged me in a maddening game of keep-away with the

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Integrated Software Packages: Summary of Features* The Software Group Lotes Development Corp. Innovative Software Inc Ashton-Tate Fromework II The Smert Softwere System \$895 \$695 List Price \$695 \$895 Extended memory Yes Yes N RAMdtek Yes Yes Yes (database only) Herd diek Yes Yes aximum w Copy protected No Yes Yes No Detabase Man 32 0009 ximum fields 256, 32 per torm window 1,000,000 plus imem records 65 000 Yes Yes Link tebles for look Yes Yes ttiple-field earl Yes (8) No Yes ndexes maintained Yes (10 per database) No No No Case geneitive searches Yes (index only) Yes Yes Yes (toggle on/off) Field-entry edit masks Yes Yes Vec Calculated field in reports Yes Configurable from 126 × 511 Maximum epreadeheet elze 32,000 × 32,000° 8 192 rows × 256 columns 9.999 rows × 999 column\$ to 4,095 × 15, or 65,000 cells Yes (with macro managem Zero-width columes Yes rning for circular references Yes 64,000 for single trame⁴ Maximum length of document 256K system: 100 pages 90 nages⁴ Decimal tabe Yes effiple-line headers and footers Yes No (yes with Top Labels) Yes No. of documents edited at once Unlimited (based on memory) ck colemn moves Yes Yes Yes No No

Yes For a complete review of Framework, Symphony, and Enable see "Integration with Integrity Framework, Symphony, and Enable," PC Magazine, Volume 5 Number 11 Theoretical number; practical usage based on memory "Only through programming." With outliner function, maximum length is unlimited. "Available as add-in program." Provides choice to update keys but not indexes \$4,000 characters per page

program: after deleting text on one line, I would move the cursor down to the next line to edit another word, only to have that word whisked away as the cursor arrived (leaving a line triggers reformatting). You can force reformatting of the current paragraph with the F2 command, and sometimes just moving the cursor has the same effect.

Yes

Yes

able of coaleats

Footnotes

Telecommunications

Smart's telecommunications module is straightforward and functional, but you'll notice that it lacks such niceties as background operation or a wide range of terminal-emulation selections. The manual provides switch settings for Haves, Popcom,

and U.S. Robotics modems (I used a Hayes 1200 external modem for these tests). You'll have to rely on Innovative Software's telephone support or your own technical ingenuity if your modern falls outside that select group. It's important to remember that even Haves-compatible modems can use different switch settings than Haves does. After the first such configuration, you'll need to reset your modem and let Smart initialize it.

Sessions using MCI Mail through Tymnet, transferring files via a null modem between a PC-XT and a TRS model 200, conducting on-line chats in terminal mode. and using Xmodem to transfer files between my office in Connecticut and those of Innovative Software in Kansas all went without a bitch

COST-SAVING FEATURES Like most communications programs, Smart's allows you to select communications parameters from a menu and save them to a file for later use. Communications menus mirror the parameters menus used in the program's other applications. The program allows you to save records of on-line sessions to a file, printer, or its own buffer. Other than reviewing it on your screen, you won't be able to do anything with this record once it's stored in the buffer except save it to a file, (the editor cannot access the buffer), but at least the buffer keeps your costs down by saving material at top speed while you are incurring on-line charges (both Symphony and Framework

If you use a modem that offers inputs

can edit such records directly).

for a telephone (the Hayes 1200 does not, but the Hayes-compatible Novation does), you can use Smarr's ability to switch between data and voice without terminating your connection. Smart offers other cost-awing features, including estimates of file transmission time (if you haven It earned it yet, some of those monster files are more cheaply sent via Federal Express) and messages posting the length of time you have been on-line.

Smart does not offer a menu-driven auto log-on procedure; instead, special verbs in the programming language sup-

Smart has the ability to switch between data and voice without terminating your connection.

port that operation (the manual includes an example incorporating them). Provided the proper security conditions have been met, the originator of a call can select a limited set of commands on the answering computer. These remote commands include those to display a directory and transmit and receive a fliet, they are each tied to the availability of password-protected access on the part of the orientator.

While Innovative Software plans to increase its terminal-emulation offerings in the future, they are currently limited to TTY or ANSI. While you may not be able to play on-line games requiring full-screen addressing, TTY is fine for on-line conversations and use of electronic-mail services.

Alongside telecommunications on Monar's central menui sa time-manager option allowing you to schedule appointments and tasks. 'Yen ever been persuaded of the value of keeping such things on a personal computer (it's never available when you need it and always requires dowthe entries when you return to be doffice from meetings), but if you'r so inclined, the one sceens better than the one in Sidetion on sceens better than the one in Sidetic one sceens better than the one in Sidewith the side of the side of the side of the white you can clone tasks and appointments, you cannot have it percentually enter that every-Monday-morning staff meeting—you'll have to remember to do that yourself.

Programming Language

Smart offers both a keystroke-maxor facility and a high-level programming language that Innovative Software terms "Project processing." Keystroke marcos can store up to two lines of text, including cursor-movement keystrokes and some function keys (command menus are unavailable in a macro). To minimize conflision, the resulting macros are also accessible through a simple menu, and they can be saved and reloaded from a file.

Project processing offers a learn mode (the Remember command) making it easy to model procedures interactively, save to model procedures interactively, save them as a project, then add the logic and link them together later. Used in the database, the Remember command will not record any data entry activities (including cursor movement within a record, recordto-record movement, or data entry). You can use Remember during spreadsheebased data entry, and you can choose to save such information or not.

Like the languages of most integrated packages, the full set of calculation functions is available in project processing, as are the command menus of each of the program's modules. Project files are free-standing ASCII text files that you can edit with the macro editor or, for more comprehensive editing services, with the Smart word processor in nondocument mode.

For faster execution and encryption, Smart automatically tokenizes projects each time you save them with the Remenber Edit command, you must do that yourself if you use any other editor. When you compile, you can save line numbers jou intend to use the "trace on" option for debugging your projects. Further debugging your projects. Further debugging support exists in the form of a single-step mode and the ability to use the FC-disculator to interrogate the current value of any variable.

INTERMODULE ACCESS As with windows, use of project files is limited to work within a single application. To access other applications, you must pass con-

trol to a project file in that application using either a Transfer (goto) or Execute (call and return) command. You have the option of sending data to that application in the form of a data interchange file or through any of the three exclusively global variable types the program supports. Four system variables allow for data-type restrictions on variable contents (values or text). An unlimited number of user-defined variables is available (at some cost of memory), but you can use only ten special variables in command substitutions. No direct support exists for saving variables to a file or restoring them from a file, although Innovative Software support has a workaround technique for doing so.

Jump (to label) and Call (procedure name) statements control program flow within a project. Procedures are internal to a project file and can be nested to ten levels. Unfortunately, Call and Return statements for routines external to the current project are limited to one level.

FORMATTING Smart's project processing operates at a slightly lower level than that of such fourth-generation languages as dBASE III or Symphony Command Language. You cannot send a report to the screen at all, and there is no corollary to dBASE's coordinate specification (@ SAY) or numeric-formatting statements. In their stead, you must use an unformatted print statement similar to BASIC's LPRINT. There are no tabs, and simple decimal alignment requires use of string conversion, concatenation, and truncation operators. Keep in mind that, with the lack of a versatile relational report generator in Smart's database, this is how you'll be constructing most of those multifile database reports. Projects can intermittently test for and branch upon specific errors, but they cannot unconditionally trap er-

rors. A Suspend function allows projects to relinquish control of the application to the operator until the selects the Execute command from the Smart menu. Speaking of menus, project processing lacks as powerful a menu werb as those offered by Symphony and Framework, an important tool when it comes to simplifying the job of menu creation. Smart does have such a verb, but it does not support Smart's native







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■ THE SMART SOLUTION

inverse-video menu-selection method (it merely displays a list on the screen) and does not automatically handle the program-branching required. The manual provides an example of how to construct a menu-pointer-based menu, but the code needed to define and move the menu pointer is complex and results in slow execution.

Learning the Program

Although Smart is a consistently strong performer, learning such a broad and sophisticated program as this is difficult. Unfortunately, Smart occasionally unnecessarily increases that challenge with puzzling inconsistencies in user interface and program design.

For example, you can interrupt a crint

For example, you can interrupt a print command by histing Cht-Z, but if you are printing a predefined report, you must use the 72 limeths law, if you want loss control with the printing of t

differ. At other times, the problem is simply incomplete or unclear prompts and documentation. Although the program uses 1-2.3-like menus accompanied by factorized the property of the property desert you one or two levels into Smart's copious menus, leaving you not course but the manual. While learning materials are formidable (electronic tutorials for its word processing, spreadsheet, and database modules and over 10 pounds of spicace documentation), novices with likely need more help understanding reliabional to the programment of the programment of a BASIC-like programment of the programment of a BASIC-like programment of the pro

Fortunately, Innovative's telephone support group gets high marks for helpfulness and follow through (despite the usual queue). In fact, customers I spoke to characterize Innovative Software as open and responsive. Longer-term users I spoke with have seen many of their magnetism.

appear as new features in program updates.

Smart is not copy protected and supports all the power equipment you might want to bolster your PC with: 8087/80287 math coprocessors. Lotus/Intel/Microsoft expanded memory, AST enhanced exnanded memory, or AT extended memory. A LAN version features file-locking in word processing and spreadsheet operations and record-locking in database operations; its pricing works out to about twothirds the equivalent single-user price. What's more, although you must start with three nodes, you can add subsequent nodes one at a time and in any configuration (spreadsheet, word processor, or database in any combination; telecommunications, time management, and programming language accompany each of the former).

Smart offers broad, consistent power across the full range of integrated software functions but can be difficult to learn and occasionally cumbersome to use. The word processor is full featured and stands out for the ease with which it merges graphs with text. Smart's database offers relational power, but it needs more support for multifile reporting on the interactive level and would benefit from a streamlined command structure. The spreadsheet is a gem: it offers the fastest recalculation speed I have seen, import/export with 1-2-3, Release 1A, and multiple-worksheet referencing and is easy to learn. Project processing, Smart's programming language, is a lower-level language than the languages in most other products of this ilk, and so you'll have to know a little more about programming and do a little more work than in comparable packages.

If your office demands the range of functions offered by integrated software. Smart will probably cost you less than standalone software while delivering near-by all the power of those packages and vast-by simplifying the job of exchanging data between them, but it will also likely prove tougher to learn and, within some applications. less convenient to use.

Richard W. Ridington, Jr., is coauthor of The Hidden Power of Lotus 1-2-3: Using Macros and a principal of Soft Industries, a microcomputer consulting and training firm in Southlington, Connecticut.

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Two AT Alternatives With Personality



The Sanyo MBC-990 and the TeleVideo TeleCAT-286 fall into the middle range in both price and design in the burgeoning ATcompatible market.

espite the new vitality that the AT-compatible markerplace has given to the word clone, a considerable range of features and price is still available in AT-style machines. At one end of the spectrum the extention place of the compatible of the perturbation of the extensive frequency of the compatible of all particular the extensive frequency of the compatible of the all particular than the extensive frequency of the compatible of the extensive frequency to the extensive frequency of the extensive frequency of the extensive frequency of the extensive frequency to the extensive frequency of the extensive frequ

Vectra and the Texas Instruments Business Pro (see "Computing Options for Power Users." *PC Magazine*, Volume 5 Number 4), that offer rugged construction, good engineering, and unique design touches. Between these two poles fall dozens of machines that vary considerably in sophistication, performance, and merch

Two machines in the middle category are the Sanyo MBC-990 and the TeleVideo TeleCAT-286. Both are reasonably priced, boast all of the requisite AT features, and even display a certain amount of individuality. The two differ in their fundamental approaches: the conservatively designed Sanyo MBC-990 offers (sw surprises, while the TeleCAT-250 has a striking, modem look. But it pays to know what's under the skir, that way you'll avoid disappointment when your fascination with good looks want by

Sanvo MBC-990

The Sanyo MBC-990 is a reasonable machine: it has reasonable solos, reasonable performance, and a reasonable price. It is neither outstanding nor partirelarly deficient in any area. And when you add up its merits, the result is a computer that is sensible rather than bring. Though the Sanyo is priced a bit higher than many low-end competitors, the extra you're paying for is the backing of a major corporation that will be around to provide support.

The Sanyo's system unit is designed in the true AT tradition: it is a bit on the large (21 by 16 by 16 inches) and hefty side (almost 40 pounds). The outside of the box, finished in cream and gray plastic, includes a system lock, power and harddisk-use lights, and space for up to four drives. The power switch is recessed into the right side of the case. A high-density floppy is standard in drive A:, and the plastic cutout labeled "B" could accommodate a half-height 360K drive, although Sanyo doesn't list one as an option. The 30-mcgabyte hard disk drive that came with the unit was manufactured by Seagate; it was reliable but not quick.

The machine comes standard with 512K bytes of RAM on the motherboard, but memory can be expanded via an additional board that will take up a slot. The motherboard has eight slots in total; once



Sanyo MBC-990 Sanyo Business Systems Corp.

Sanyo Business Systems Copt. 51 Joseph St. 1 Joseph St. 1

Expansion Slots: Eight (six available for options)
In Short: The conservative MBC-990 offers few surprises, but users can (with the help of a

tew surprises, but users can (with the help of a screwdriver and a software utility) switch between 0 and 1 wait states.

ORCLE 648 ON REAGER SERVICE CARD



Measuring 21 by 16 by 16 inches and weighing, in at 40 pounds, the Sanya MBC-990 is large, it is pictured here with an IBM-compatible RCB manitar transfavared by Sanyo, Inside, the mother board offers eight expansion slats in total; after you install the necessary drive controllers, six will be available. The dail-speed CPU switch is in the rear of the system unit tright).

you put in the necessary drive controllers you will have six available slots—more than enough for most people. The system design is acceptable if uninspired, with neatly done wiring and a sturdy appearance.

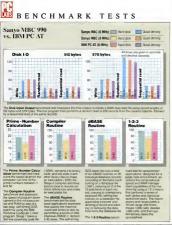
The Sanyo runs at either 6 or 8 MHz; in the rear of the system unit. Sanyo has added one interesting feature that many other dual-speed CPU in the rear of the system unit. Sanyo has added one interesting feature that many other dual-speed units lack: a software unitly hast less you switch bestuden 1 wait states, which should help ensure maximum of the system of th



tools into electrical appliances when I couldn't see what was going on. An easierto-use hardware switch would be an improvement.

FINISHING TOUCHES The configuration I tested included an IBM-compatible RGB monitor manufactured by Sanyo, with convenient front-mounted controls for brightness and contrast and a pushbutton on/off switch. In the back are adjustments for vertical and horizontal hold, vertical line, and beight.

The monitor's performance exactly matches that of an IBM color monitor with



The Sanyo MBC-990 runs at either 6- or 8-MHz. PC Magazine Labs tested it in both modes. The results are right in line with those of other 8-MHz ATs, although the disk drive could have been perkier. While the Sanyo is not an astounding machine; it successfulls weitheres its modest words.

a CGA card—barely acceptable for text. Like any other good medium-resolution 12-inch monitor, its specs include 38-millimeter dot pitch, a maximum resolution of \$20 by 200, and the large grainy letters that PC users with CGA cards have grown to barely tolerate.

Although you can move the monitor about on the top of the system box, it has no true tilt-and-swivel feature, an amenity that many PC users have come to expect as standard on compatible machines.

with IBM Selectric-style placement of the alphanumeric keys and an AT layout with the Esc key unfortunately located on the right side. Green indicator lights for Num-Lock, SeroIILLock, and CappLock are embedded in the keys, a system I prefer to LEDs placed desswhere on the keyboard. The typing feel is good and solid, and the keyboard aligns to two typing angles. The audible feedback is a bit noisy and distracting for my tests.

The Sanyo keyboard is comfortable,

The Sanyo's performance is in line with that of other 8-MHz AT alternatives, although a perkier disk drive would be an asset. Compatibility is perfect: the Sanyo even ran some graphics-intensive game programs that often hang up other AT machines.

The Sanyo includes DOS 3.1, GWBA-SIC, a user guide, and a "getting started" manual. Not included are the display interface, hard disk drive, and parallel and serial ports. Any unit that wants to compete effectively should include these in its standard configuration.

The Sanyo doesn't try to be flashy or particularly unique, and it succeeds in achieving its apparently modest goals. It won't astound or surprise you, but as long as it meets your expectations, that's not such a bad thing.

TeleVideo TeleCAT-286

While the Sanyo looks like a modest computer, the Tele-Video TeleCAT-286's design screams out promises of excitement and high performance. The Korean-made machine has a very attractive design, a superb monitor, and a small footprint. In the final analysis, however, the design features are uneven and the performance somewhat disappointing for such sleek equipment.

The brown and beige TeleCAT looks great standing still. The three-piece unit offers some superior ergonomics—to a point. The real standout is the monitor: the review unit was equipped with a green monochrome monitor capable of 600 by 400 resolution.

Considering TeleVideo's heritage in the terminal marketplace, the outstanding monitor makes sense. Text characters on the 14-inch screen are extremely crisp and easy to read, thanks to the high-resolution interface card that TeleVideo includes. The monitor consess with its own tilt-andswived base and doesn't need a separate power cable. The monitor cable contains the power connection so that you have at least one less wire to deal with.

While the monitor is uniformly excellent, little attention was apparently lavished on the keyboard. The AT-style keyboard, manufactured in Taiwan, has a sort of soggy feel. LEDs are built into the locking keys. I would have much preferred a stiffer feel and the inclusion of a separate cursor pad. However, the keyboard connector was standard, and there is no reason you couldn't switch to a different keyboard.

TINY FOOTPRINT The TeleCAT's system unit also exhibited some odd design inconsistencies. On the outside, it shares some of the fine traits of the montry, with the same attractive design and a footprint almost one-third smaller than the BM PCAT's. But the convenience of the smaller footprint requires some compromises.

First, the motherboard has only five sots in all, and only three are available for options. The motherboard is socketed for I megabyte of RAM and includes the serial and parallel ports, but three open slots may still not be enough, depending on your plans. The TeleCAT also has the now de rigueur dual-speed (6- and 8-MHz) 80286, which you toggle via a small slide-switch in the back of the milt.

The final design curiosity is the on/off switch, a very small rocker switch located on the back of the unit. A front-or at least side-mounted switch would be commensurate with the other thoughtful design features. The internal construction and layout shows care in manufacture, although the



TeleVideo TeleCAT-286 TeleVideo Systems Inc.

1170 Morse Ave. Sunnyvale, CA 94088 (408) 745-7760

(408) 745-7760 List Price: With 512K RAM, 1.2-Mbyte floppy disk drive, 20-Mbyte hard disk drive, monochrome monitor, serial and parallel ports, 52.995. With 30-Mbyte hard disk drive, 53.495.

Microprocessor: 80286 Clock Speed: 6 MHz or 8 MHz Expansion Slots: Five (three available for

In Short: A sleek package with an excellent monitor, but the all-in-one unit makes some compromises, and power users may not find

enough expansion stors.

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The star component of the sleek TeleVideo TeleCAT-286 is its monitor, which is capable ce 6000-by 400-pietel resolution. Like the Sarryo MBC-990, the TeleCAT-286 comes equipped with an extremely slow Seaquet 20-megabite hard disk drive that stiflets some of the unit's capabilities. The moherboard contains only three available expansion slots (right), not enough for some users.

unit doesn't convey the sense of solidness that some other machines (like the TI Business Pro or even the Sanyo) do.

ALLINONE In designing the TeleCAT. TeleVideo's philosophy, an admirable one, is to offer a total package so that users don't have to worry about configuring the machine. Besides the high-resolution monitor and serial and parallel ports, a 20megabyte drive is standard and a 30-megabyte drive optional. Unfortunately, Telediview that the sits of the standard of the standard drive that reiss in the performance of this



The TeleCAT has no problems running the most popular business software, and working with applications like Word Perfect and Framework II on the high-resolu-

tion monitor is a real joy.

Is the TeleCAT a good choice? That depends on your budget and your experi-

BENCHMARK TESTS TeleVideo TeleCAT-286 TeleCAT-286 (6 MHz) Hard disk Quad density vs. IBM PC AT TeleCAT-286 (8 MHz) Hard disk 📋 Quad density IBM PC AT (6 MHz) | Hard disk | Quad density All times are given in seconds Disk I O 512 bytes 578 bytes 120-The **Disk input Output** benchmark test measures the time it takes to create a 200K byte data file using record lengths of 50 bytes and 578 bytes. The test program then performs a random read of 256 records from the created data file. Sollowed by a sequential read of the same records 1-2-3 Calculation Routine 40 60 30 ation benchmark test mea-sures the speed at which the computer can find all the applications, designed for a 640K-byte environment, as sesses the computational speed and RAM managetwo-step, self-terring DOS batch file using the IBM Personal Computer Linker

The sleek appearance of the TeleCAT-286 promises high performance, but the actual test results are not exceptional. Its slow Seasate drive reins in the performance. Note that in several Disk I/O tests the times for the 6-MHz mode are faster than those at 8 MHz, indicating poor integration of the disk drive, drive controller, and microprocessor.

The 1-2-3 Routine bench-

ence. There is no denving the attractiveness of purchasing a complete system from a single source. The outstanding monitor and tiny footprint could clinch the deal. But for a power user, the footprint might be a poor trade-off for the paucity of expansion slots and the slow drive.

Another important consideration is price. The TeleCAT is less expensive than the AT, but it's not the most reasonable deal around by a long shot. Like Sanyo.

however, TeleVideo is a major company (currently selling more micros than Olivetti, Xerox, or ITT), and you might think it worthwhile to pay the premium for the support. If you value style and yearn for a spectacular monochrome monitor, the TeleCAT may seduce you into forgiving its shortcomines.

Jon Pepper is a frequent contributor to PC Magazine.

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GRAPHIC SYSTEMS

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Micro-to-Mainframe Connections: REMOTE POSSIBILITIES

he venerable 3270 terminal has become a de facto standard with many large IBM and non-IBM mainframe computer systems. The great majority of these terminals are arranged in local cluster configurations, interfacing with a control unit over coaxial cable. Because data transmitted over coaxial cable camnot be directed to a modern, these configurations are generally limited to local use. (Boards that let your PC emulate a 3270 terminal in a local configuration are reviewed in "A Window on the 3278 World," PC Magazine, Volume 5 Number 9.)

If you need to communicate with a mainframe or cluster controller that is not local, you need a remote 3270 emulation package. These products, which let your PC emulate both a control unit and a display station from the 3270 family, communicate with the mainframe over standard did-up or leased telephone lines through internal or external synchronous moderns (see "The Path to Remote 3270 Emulation"). The products here and in the next issue perform a subset—and, in some cases, a superset—of the functions of a "mail" IMB AZYzterminal.

The 3270 terminals that operate over long-distance communications links use one of two communications protocols: binary synchronous (also known as bisync or BSC) or SDLC (the commonly used acronym for Syn-

If you need to talk to a remote mainframe, you can do it over phone lines with a remote 3270 emulation board. Enough variety is now available so that you can choose one that matches both your needs and your mainframe's communications protocol.

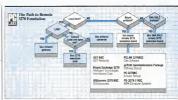
chronous Data Link Control).

Bisync has been in wide use for more than 20 years, which is probably its major attraction for users who need a micro-tomainframe connection. Most large comnuter systems, particularly the ones that have been around awhile, were delivered with bisync interface hardware and software as standard equipment. As far as line efficiency goes, bisync was good in its time, but by today's standards it falls short. The major problem is that bisvnc is essentially a half-duplex protocol: data can be transferred only in one direction at a time. As with some asynchronous protocols such as Xmodem, the sending computer must wait for an acknowledgment to each data block it sends before it can transmit the next block. Despite these drawbacks bisync is still widely used; we've reviewed bisync 3270 emulators in this issue.

SDLC, on the other hand, is a relative newcomer to data communications. In use for just a short time, it has spread to many older IBM installations, though it usually requires adding new hardware and software. SDLC is practically mandatory on new systems. Among SDLC's many advantages are its full-duplex communications method: a transmitter can send up to seven data blocks before it must receive an acknowledgment. This capability is extremely important if you are communicating over satellite connections, where turnaround time is very long. (A sender using bisync over satellites may actually spend more time waiting for an acknowledgment than sending the data.)

and conduct use and conductive co

A data processing system manager considering which protocol to use with a new computer system would probably be wise to choose the SNA/SDLC protocol. If you are a PC user who wants to connect to an existing mainframe, the choice may not be



A remate 3270 emulator board can link your PC with a mainframe at a remote site. The products reviewed here work with mainframes running the bisync protocol.

yours: you have to work with the protocol running on that mainframe. Contact the person responsible for your systems communications to find out.

MODEM STANDARDS Because both bisync and SDLC are synchronous protocols, they cannot use modems that have only asynchronous capability. Although a true Bell-212-standard, 1,200-bit-per-second modem is capable of handling synchronous protocols, it must be specially configured to do so and is not generally used for this purpose. Similarly, the new Haves 2,400-bps asynchronous modem also supports the CCITT (Consultative Committee on International Telephony and Telegraphy) V.24 standard for 2,400bps synchronous transmission, but it is doubtful that this standard will catch on in the United States (CCITT standards are rigidly followed in Europe and South America). Hayes is actively promoting the Haves Synchronous Interface (HSI), but only time will tell if it gains wide accep-

tance. The most-popular modem standards in the 3270 dail-up market are the Bell 201 and the Bell 208, which communicate at speeds of 2,400 and 4,800 bps, respectively. The use of these moders in maintaine installations over the years has meant that most companies remoters in maintained them as standard. The most popular manufacturers of these devices are UTDS (whose 208A) B model was used in our testing for this article. ATER ISM. and Read-1961.

Prices range from about 5500 to 5900 for 2 nd 20 to about 51,200 to 52,000 for 20 as compatible. It is possible to attain speech of up to 9,600 to 500 attain speech of up to 9,600 by over a telephone line and 56 kilobits per second with specially conditioned T1 telephone circuits; stam-dards in these areas vary among manufacturers; make sure you consult with your systems manager to determine the proper device to purchase. (A future article will review synchronous moderns.)

In the past, if you wanted to automatically dail in a synchronous environment, you had to piggyback an extra ACU (automatic calling unit) device onto your modern. Now special models of these moderns incorporate the auto-dialing mechanism internally. Also recently introduced are 201 and 208 auto-dail moderns contained on internal PC expansion these products include UDS and Clost Order, ware, which also markets software written to work with its modern.

FILE TRANSFER One great benefit to 3270 terminal emulation is that you can transfer data between the PC and the mainfiname. The packages reviewed in this issue generally transfer files using one of two methods: simple screen dumps or file transfer using the mainframe operating system's program editor. The screen dump method is simple, but messy and time consuming; you page through the mainframe dausest and save it to disk one screen at a time, including all the attendant garbage.

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Remote 3270 Emulation Boards: Summary of Features

SERVICE S	AST-BSC AST Research Inc.	pcPath Communi- cations Package Pathway Design	IDEAcomm 3278/BSC IDEAssociales	Risync Exchange 3278 Intelligent Technologies International Corp.	PS-327X- 2/BSC ABM Computer Systems	PCLAM 32748SC Cleo Software	PC/ 3278BC Emulex Persyst
List price	\$695	\$890	\$895	\$995	\$995 to \$2,585*	\$1,195	\$1,600
Terminals/controllers emulated	3274 Model 51C; 3278 Model 2; 3279 Model 2A	3271 Model 2; 3275 Model 2; 3277 Model 2; 3278 Model 2; 3279 Model 2	3275; 3276;	3274 Model 510; 3276 Model 2; 3277 Model 12; 3278 Model 2; 3279 Model 2	3276 Model 2; 3278 Model 2; 3279 Model 2A		
Application program interface	Standard	Standard	N/A	Standard	N/A	N/A	N/A
Status Indicators Where displayed	25th iine	Bottom line	25th line	Bottom line	25th line	25th line	25th line
Type	Characters	Characters	Symbols	Characters	Characters	Characters	Characters
Diagnostic program or trace routine	•	•	•		•		
Maximum speed (bps)	9,600	9,600	19,200	9,600	9,600	19,200	9,600
Automatic dial support				No, but is available			
Internal modems supported		•			•	•	
NRZI (Nonreturn to zero Inverted) data encoding	•			•		on synchronous	
File-transfer software	Standard	Standard	Standard	Optional	Optional	Standard	Standard
Types of Transfer Available Screen dump to tile			•	•			
Using TSO EDIT	•	•		•	•	•	
Using CMS EDIT	•	•		•	•	•	
CICS		•		•	•	•	
Other					iBM host- supported†	IBM host- supported†	Screen capture to disk or to printer
User-definable keyboard	•	•	•	Configuration program available			•
No. of international keyboard layouts available	13	19	9	Configuration program available	0	0	0

The slightly more convenient editor medical works with the two main IBM operating systems. TSO time-sharing option), which uses a line editor called EDIT, and the state of th

N/A = not available. "See fact file for specific price inform

TESTING METHOD We were fortunate to come across a software package that could thoroughly exercise all the emulation packages we tested. The 2270 Quality Assurance Package from Software Research Corp. tests an emulator 9 Program Function (PF) keys, Program Attention (PA) keys, Enter and Clear keys, attributes with a formatted screen, formatted screen with protected and unprotected fields, 32

basic attributes, advanced attributes, cursor insert function, program tab function, set buffer address (SBA) function, cursor

addressing, and printer operation.
The reviewers set up and configured each package prior to testing it, not a trivial task. Bisyne emulators must be told what control unit (CU) and device address they are to respond to, while SNA packages must be given the physical unit (PU) num-

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The 2400I Internal Modem Card fits into any expansion slot, as it is a compact half-card modem. It's designed specifically to operate in the IBM Personal Computer PC/XT/AT family and compatible computers. The rear panel has two RI-11C modular telephone jacks for the telephone line and the telephone set. The modem can be set for COM1 or COM2. The 2400I modem allows asynchronous communications with remote computers and other data terminal equipment over standard voice grade telephone lines. The 2400E External Modem offers the user asynchronous or synchronous communications. The 2400E is en-

He Bisk Sparantee



SOUT 1200 Saud, Fully Hoyes "AT" Command Set a Cord, PC TALK III Software

closed in a slimline plastic enclosure. The front panel displays the eight modem status indicator lights. It works on any computer or terminal with an RS-232C serial port.

Not to be forgotten are our 300/1200 baud modems. The Internal Modem Card is designed for the PC, PC/XT and most compatibles; it occupies one full length slot and the internal speaker lets you know the call progress. An RS-232 serial port is standard, COM1 or COM2; you can use the port for other peripherals when the modem is not being used. Our External stand alone modem can be used with any computer or terminal which utilizes an RS-232C serial port. It also comes with 8 status indicator lamps and a snap off front panel that allows for quick setting of the switches for all types of communication packages. At \$139 and \$149, these are the best price/performance modems for most communications

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ber, the logical unit (LU) number, and an ID address. You obtain this information from your system administrator.

The bisyne products reviewed below have several basic features in common. All support both the point-to-point and multipoint protocols, all 24 program function keys, and a "hot key." Beyond these and some other basics, the packages cover a wide range of functionality (see "Remote 270 Emulation Boards. Summary of Features"). Although some have clear advantages for all users, most will have to choose the one had best listed particular to those the one had best listed particular BMM, the company that invented the 3270 terminal, chose not to supply its bisyne ronce emulation board for this review.)

DOCUMENTATION AND SUPPORT For good terminal emulation, maintaining close compatibility with the emulated terminal is often not enough. If your terminal is not configured correctly, it could cause others on the network to lose communication. You may run into political problems as well: many managers are opposed to the proliferation of PCs that can be connected to "their" host system. For these and many other reasons, the product must be well documented, and the manufacturer's backup support for that documentation must be better than for other products. While the systems operation staff may be helpful, they may also have no idea how to configure or operate a personal computer. You may end up blazing new territory; don't try to do it without the support of a good manufacturer.

Some of the packages that we tested comprise software from one manufacturer and hardware from another. We see nothing wrong with this approach as long as the vendor takes ultimate responsibility for maintaining and supporting both pieces.

—Bill Harts

AST-BSC

AST-BSC from AST Research emulates the 3274 Model 51C with a single 3278 Model 2 or 3279 Model 2A display station. While the package does not allow you to connect additional PCs or use multiple sessions, it is a good buy at \$695 for software, expansion board, and file-transortware, expansion board. Maintaining close compatability with the emulated terminal is often not enough.

fer software. A printer connected to the PC can emulate the IBM 3287 printer. As for documentation, each manual has

its own heavy paper cover, but all three manuals are packaged in one binder, a design that makes it difficult to track down specific information. I prefer tabbed dividers that at least separate each manual, if not each section within the manuals.

The file-transfer software uses EDIT under TSO and XEDIT under CMS. While this design results in slow data transfers, it is better than the file-transfer capabilities I have seen on other 3270 bi-sync products. The file-transfer manual is well organized and contains much good technical information. Inexperienced users, however, might have trouble understanding how to use these file-transfer util-standing how to use these file-transfer util-

I found the default keyboard configuration a little unusual and difficult to use. The FF key functions are assigned to the PC's function keys, and other special keys are located along the top two of the FC keyboard. On 2570 display stations, this layout is reversed. This problem can be corrected by recofiguring the keyboard, but the manual warns you not to try that makes you have a good understanding of makes you have a good understanding of you or of 13 international keyboard configurations can be select.

COLOR SUPPORT The configuration program asks if you have a monochrome or color monitor. If you have color, the emulator will use the standard four-color set used with 3279 display stations. The mainframe was not configured for color support, but the emulator gave me the

proper colors anyway.

I liked the diagnostics that come with
the AST board because they allow you to

test the product in two ways. You can test the board with a jumper plug that comes with the product, and you can test the local modern and the board if your modern has digital loopback capabilities.

AST tends to use default interrupt requests (IRQs) that conflict with other options. Fortunately, all of the company's products can be reconfigured for other IRQs to eliminate this problem. As with the keyboard remapping, the manual recommends that you leave IRQ and I/O address chances to experienced people.

A nice and somewhat unusual feature of the AST-BSC is its Application Program Interface (API), which can be used with BASIC, C, or any language that has an interface to allow calls to assembly language routines. With the API, experienced users are able to write programs that take control and automate the functions of the emulator.

AST's manual contains much basic information aimed at novices and many warnings cautioning inexperienced users not to attempt technical operations such as reconfiguring the keyboard. Some manufacturers assume that everyone has some knowledge about 3270, and for bisyne



AST-BSC AST Research Inc. 2121 Alton Ave. Irvine, CA 92714 (714) 863-1333 List Price: 5695 Regulres: 1928 RAM, one disk drive, DOS

2.0 or later.
In Short: A 3274 Model 51C emulator that supports only one display station. An applications program interface and file-transfer software are included as standard features.
IFFLINE OF INFLINESSIES OF ACTUAL STATES.

communications this is probably true. AST doesn't make any such assumptions, which makes this a very attractive choice for inexperienced users who need remote communications. - Charles Teets

pcPath Communications Package

Every so often, PC Magazine Labs tests a product that surprises everyone by doing something it's not supposed to do. The pcPath Communications Package from Pathway Design is one of those products.

Its surprising feature is concurrent sessions on the mainframe. Multiple sessions are a common enough feature on SNA products, but no one at PC Labs had seen a 3270 bisync emulator that could handle multiple sessions on a single PC. When I announced that pcPath could manage this feat, one of our synchronous communications experts insisted I must be misreading the manual.

So strong was this feeling that when I got this package logged on to the mainframe in three concurrent sessions. I called



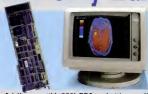


pcPath Communications Package Pathway Design; 1 Apple Hill; Natick MA 01760; (800) 343-0515 List Price: \$890

Requires: 256K RAM, one disk drive, DOS

In Short: Up to five concurrent sessions, a redefinable keyboard, and a clear manual are just some of the features that characterize this high-quality, well-designed package. CIPCLE \$50 ON READER SERVICE CARD

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MICRO TO MAINFRAME

someone over to witness the feature—just to make sure I wan't hallucinating. In fact, the pcPath Communications Package can handle up to five concurrent sessions. According to Pathway Design, as many as three of these can be print sessions, each actively printing to disk in background while you do something else.

Unlike in a typical ŠNA product, these sessions take up the whole screen rather than using windows. You can see only one session at a time; you flip from session to session with Alt-F10. But the concurrency itself is already far more than any other bisync emulator offers, to the best of our knowledge.

OTHER PLUSES Even without the concurrency feature, the pcPath Communications Package would be worth looking at. It's filled with such useful features as on-screen help, redefinable keyboard layout, and your choice of symbols or characteristics.

ters for bottom-line status indicators. The package even incidates three choices file transfer—TSO EDIT, CMS XEDIT, and CICS (Customer Information Control System, another mainframe operating system). (The pcPath Communications Package covers only the PC side of the communications and requires the standard IBM packages on the mainframe.)

Every pcPath feature leaves an impression of quality. The manual's clear writing and professional design make it easy to find—and understand—the information you need.

The careful planning behind this package even extends to such things as the keyboard template. Like most 3270 emulators, pePath's template shows all the standard PC keys plus the extra keys defined by the package. Unlike most, the package also includes a second layout chart on the back of the card that shows all the standard PC keys but lets vor fill in the

3270 keys as you have redefined them.

Installation of the pcPath Communications Package is simple enough Jumpers on the board come preset so that in most cases you only have to plug the board in Should you need to change anything, the manual gives you the information you meed, though you'll have to know what I/O address and interrupt level to reset. Pathway Design offers a full-free customer-

support hot line to help out. The software configuration program is a little more complicated but only because it gives you control over so many paramiers. The manual explains these well enough, however, and you can probably set the program up without the manual if you just skip over the choices you don't understand.

If you have a color monitor, pcPath tells the mainframe you're using a monochrome terminal, but it will supply color for you locally. The configuration pro-

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gram lets you define 4 colors out of a palette of 16: for both protected and unprotected fields in normal intensity and high

As shipped, pcPath defines the PC's Enter key as Enter and uses the PgDn key for New Line. The PF keys run across the top lines of the keyboard from Alt-F1 to Alt-Equal sign and from Alt-O to Alt-P. finishing up with Alt-A and Alt-S. As I've already indicated, though, you can redefine the keyboard to taste, which is more important than any particular layout.

pcPath handled the emulation tests without a problem. It ignored a few advanced features such as blinking fields and inverse video fields, but Pathway doesn't claim to support these advanced attributes. Well, you can't have everything. But this

board comes close. -M. David Stone IDEAcomm 3270/BSC

The IDEAcomm 3270/BSC, one of a series of 3270 terminal emulation products from IDEAssociates, emulates a wide variety of 3270 terminals and controllers, in-





IDEAcomm 3270/BSC 1DEAssociates, 35 Dunham Rd., Billerica MA 01821: (617) 663-6878 List Price: \$895 (board only, \$295; software only, \$695)

Requires: 128K RAM, DOS 2.0 or later. In Short: Emulates a wide range of 3270 BSC products but does not allow you to attach additional PCs as display stations. Has primitive file-transfer capabilities. Good technical information for experienced PC

and 3270 users ROLE \$49 ON READER SERVICE CARD

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cluding 3271, 3274, 3275, and 3276 cluster controllers and 3277, 3278, and 3279 display stations. Despite this versatility, however, the product is very limited in other ways. For starters, unlike some other emulation packages, this one does not allow other PCs to be connected directly or accessed through a network but allows only one PC to access the mainframe.

The IDEAssociates manual is a hindrance to using and installing the IDEAcomm 3270/BSC. Its physical design is clumsy: if you bind the 51/2- by 81/2-inch pages in an IBM-size binder, the type appears sideways on the pages. The contents are good-especially the abundant technical information-but the lack of an index makes entries difficult to find.

File-transfer capability is severely limited; you can do only primitive, one-way transfers up to the mainframe. Screen images must be created off-line and sent up to the mainframe one at a time. I found this process cumbersome and at times difficult to use. Products that emulate the 3270 should always have some type of filetransfer capability to take advantage of the power and storage of the PC.

KEYBOARD OUIRKS Another disapnointment is the lack of a keyboard template. When I went looking for the Clear and Reset keys. I had to furiously flip through the manual to find the page that described the keyboard layout. This layout is not mentioned in either the table of contents or the index

The default layout displays an IDEAssociates quirk: WordStar-like Ctrl-key combinations. Non-WordStar users will find this design confusing. The PF functions are assigned to the ten PC function keys, an approach I don't like because it diverges from the traditional 3270 layout and is hard to get used to. You can change the keyboard to any configuration you want, which is certainly an asset, but since it lacks a template, you get no help in finding specific keys.

I ran into problems because the switches on the half-card interface board (called the Minicomm by IDEAssociates) were not set properly. After a half an hour of frustrating searches through the software manual, I gave up and called the vendor's support group. Otherwise the Minicomm is easy to install and configure. The separate manual that came with the board, although brief, was in a better format than the manual for the software.

Fortunately, the news about the IDEAcomm 3270/BSC is not all bad. While inexperienced users should stay away, experienced and highly technical users will appreciate the technical information that the software manual gives. The status line at the bottom of the screen will also please experienced users. The characters used on this status line are close approximations of



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the icons used on real 3270 display sta-

tions.

The printer configuration allows either no printer, a buffered printer, or an unbuffered printer. This nice feature allows you to use a variety of printers without over-running one type or slowing down another.....(*batlets Teefs.

Bisvnc Exchange 3270

 national Corp. was the first board to pass this test—and the last board that O'Cone had to bother with.

Ironically, it may be easier to install the Bisync Exchange 3270 if you're in a hurry than if you're willing to read the manual. As with most 3270 emulator boards, the Bisync Exchange 3270 comes with jumpers and DIP switches, and the manual suggests you check the settings before installing the board. Unfortunately, the drawings in the manual are based on an earlier version of the board-the current jumper blocks are in different positions and have different numbers of pins than the manual shows. If the settings are right, you can plug in the board and move on to other matters, but you'll either have to take the settings on faith or call Intelligent Technologies to check. According to Intelligent Technologies, the manual is currently being revised to match the new board. Making up for any confusion with hardware settings is an extremely simple configuration program that ask for only six values. Three are concerned with the board itself and will not normally need to be changed. The other three are the control unit address, the number of "catagory of chedital printer port. Bill those in, hi il Se to save the changes to disk, and the unit isistalled. All that remains is to load the emilation program and establish the modern connection with the mainframe.

NEVER-NEVER LAND On most of the emulation tests, the Bisyne Exchange board worked just as it's supposed to, but on one test I was consistently sent to nevernever land. The modern connection was never broken, but I had to log back onto the system each time.

Intelligent Technologies suggested that I look for a Read Buffer command, which "can crash this board." The board doesn't

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support this command because it is a diagnostic command, and Intelligent Technotogies feels it is not likely to be used in applications programs. Of course, in testing the boards, the bost computer was running diagnostic routines. And, of course, the test that created problems included the Read Buffer command

he side some object of the side of the sid

The hot-key feature will let you shift into DOS with a simple Alt-D. To get back to the emulation, you must type EXIT at

the DOS command line.

All file-transfer capabilities are option-

al, at \$395 for a screen-dump feature, \$500 each for TSO EDIT or CMS XEDIT, and \$2,000 for CICS. (These prices include the mainframe side of communications as well as the PC side.)

KEYBOARD LAYOUT Whether you, like the keyboard injour on a 3270 miles to keyboard to it always a matter of taste. The Bisymon Exchange peckage puts all 24 Fe Beyon on the function keys in combination with Crit and Alt. For New Line and Enter, a opts to the Company of the Company of the Company New Line function to the PC's Enter the and assigning the Enter function to the PC's Pix's key. If you're coming to this package as a 3270 user, you'll probably find this layout comfortable. If you're the Company of the Company of the Company of the White I have the Line key whetherer was

mean to hit Enter.

More important than the keyboard layout as shipped is whether the package lets

you change it. Intelligent Technologies offers a configuration program on request. This offer is not as good as getting the program automatically with the package, but it comes close. Unless your biases happen to match the default layout exactly, I strongly recommend you request the configuration program. —M. David Stone

PS-327X-2/BSC

ABM Computer Systems* FS-327/KBSC line offers 3276 Model 2 emulation with 3278 Model 2 and 3279 Model 2 And sight wriminals. There are three versions available: PS-327K-1 is standatore only, PS-327K-2 allows up to three additional PC connections, and PS-327K-3 allows up to 12 additional PC connections. I event on the 2 version, which includes five ribbon cables for connecting to the model can other PCs, and to a printer. Only one printer can be connected to the cluster-control-

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ler PC, but each display station PC can have its own printer to emulate an IBM 3287 printer.

If you need to connect several PCs to a mainframe through one remote line, this may be the product for you. It is one of only two reviewed here that support additional PCs without additional hardware. The manual does, however, caution against connecting too many PCs: the PC

emulating the cluster controller may bog down, and the single line to the mainframe may slow down all the PCs emulating 3278 or 3279 display stations.

At first glance the documentation looks good. You may change your mind, as I did, when you try to quickly find something in one of the three manuals. These manuals are packaged in a single binder with nothing separating them. The lack of tabbed dividers further complicated my search for information about installation and operation. I did find a great deal of useful technical information, but there is no start-up section to help you get the board and software installed and running.

The file-transfer software, from CDI Systems, allows PC-to-mainframe transfers using either the TSO EDIT (or CMS XEDIT) program or IBM's Host-Based File Transfer program set, I did not have a chance to use these programs in this evaluation, but I have used the CDI programs with other 3270 emulation products. These utilities give you a great deal of flexibility but may be above the level of inexperienced users.



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Bisync Exchange 3270 Intelligent Technologies International Corp. 737 Lincoln Centre Dr. Foster City, CA List Price: \$995; screen-dump software, \$395; TSO EDIT or CMS XEDIT, \$500; CICS, \$2,000

Requires: 128K RAM, one disk drive, DOS 2.0 or later. In Short: Simple to install and fairly reliable

to use, the Bisync Exchange 3270's biggest flaw is confusing setup information. Filetransfer software is priced separately CIRCLE \$40 ON READER SERVICE

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GOOD LAYOUT ABM does not provide a facility for reconfiguration of the keyboard, but the default layout is very good. The PF keys use the top row of the keyboard combined with the Alt and Ctrl keys. This approach is closer to the true IBM 3270 keyboard layout. Also like IBM's design, other special keys on the PS-327X-2/BSC use the ten PC function keys. Four different keyboard templates were included with the PS-327X-2/BSC, but they seemed incomplete: I could not find the Reset key.

The mainframe configured the "terminal" as a 3278 Model 2 display station without color support, even though we were using a PC-XT with a color monitor and color/graphics card, but like many other products, the PS 327X-BSC first checks to see if you have a color card and then supplies the correct colors for high and low intensity and protected and unprotected fields

Features merit careful consideration, but the bottom line, of course, is functionality. I had trouble getting the board to communicate with the mainframe, and the manuals were of little help. While I found information about running the diagnostics. I could not find anything about what to do in case of a failure. A call to the customer support department at ABM, however,

saved the day. The diagnostics themselves are comprehensive and easy to use, but they lack information about interpreting error messages and about what actions to take once errors are discovered. Error messages are, however, valuable aids for when you call the customer support staff.

Experienced users won't be tripped up by the difficult-to-use manuals and will manage to correctly install and use the PS-327X-2/BSC. It's probably worth the trouble for two reasons: the ability to hook up one more PC as a display station, and the



In Short: A 3276 Model 2 emulator that alfows up to 12 additional PCs as 3278 or 3279 display stations. Uses the competent CDI Systems file-transfer software. LE SATON READERS

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Need information from the company mainframe or an outside service? Just point to the desired Service ican. Torus offers a family of network agreways* that automatically make the connection and speed your information through.

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What good is a network if your people don't know how to use it? Tapestry's screens are so easy to understand, anyone can net great results without special skills ar fraining.

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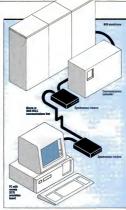
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■ MICRO TO MAINFRAME

A typical remote microto-mainframe setup in a 3270-family environment. The PC. emulatine both a control unit and a display station, municates with a frame via synchronous modem: and a communications line that uses either the history or SNA/SDLC protocol. On the mainframe end. a 3705 communications controller handles the system's communications

chores.



good keyboard, which is the closest I've ever seen to a standard 3270 layout. Less technically sophisticated users shouldn't attempt to conquer this package without the help and advice of a good technical support person. -Charles Teets

PCLAN 3274BSC

Cleo Software has enhanced its 3270 bisync emulation package to work with local area networks that incorporate IBM's NETBIOS, which allows programs to communicate with other PCs on the network and their applications. Anyone who has the PC Network installed can use this product as a true 3270 cluster controller. supporting up to 32 displays and printers. The only thing wrong with this approach is that IBM's PC Network has trouble handling that much traffic. There may be some hope, however, when IBM releases

all of the goodies for its token-ring network, because the token-ring is less susceptible to slowdowns caused by heavy

At \$1,195, Cleo's PCLAN 3274BSC is a good deal for non-copy-protected software and an interface card. A variety of products were pulled together to make the package work: the interface card is the ADCOM-2 board from Frontier Technologies, and the file-transfer software comes from CDI Systems. The emulation software includes programs that run on the controller PC and a program that runs on the display PCs that use NETBIOS to access the controller PC and the 3270 network. The ADCOM-2 board is easy to install, but the ADCOM manual does not come with it. Instead, the Cleo manual includes one inadequate page on the board, covering setup information for its switches and jumpers.

What documentation there is for this package is quirky. A cable, for use in a dial-up environment, is described in the manual, but the cable sent with the product was not wired the same way as in the diagram. Further back in the manual, I found another cable diagram that conformed to the cable we received. Different technical writers may have worked on parts of this manual and may have introduced some inconsistencies.

FILE TRANSFER The PCLAN's filetransfer software comes in two versions. One of those versions, IBM Host-Based File Transfer, requires additional software on the mainframe but transfers data much faster than the standalone version. The standalone version uses the line-at-a-time editors EDIT (under TSO) and XEDIT (under CMS), which cause a lot of backand-forth handshaking after each line and thus slow down data transfers. The filetransfer documentation is in a different format from the emulator manual and is heavily oriented toward technically oriented users

Cleo supplies 16 copies each of the keyboard template and keycap stick-ons. which can save users a lot of time if they are using the product in a large network environment. The layout of the PF keys, PA keys, and New Line key are a little unusual and may take some getting used to. Unfortunately the keyboard is not reconfigurable, and I had to rely heavily on the template.

INSTALLATION The installation program, which configures the emulator software, allows you to customize some of the product's features but not to specify addresses for the control unit. This limitation caused me no problems in my tests, but an installation in which the cluster controller has an address other than 00 will have problems.

Fortunately, we did not have to change the I/O address or interrupt request (IRO) for this test. When either of these parameters is changed, the emulator must be executed with a string of options. Cleo does provide a way around this problem: the installation program allows you to create a default option line that automatically appears each time the emulator is executed.

Cleo supplies 16 copies each of the keyboard template and keycap stick-ons, which can save users a lot of time.

The same solution could also be achieved with a batch file.

If you have technical expertise with 3270s, you'll have no trouble using Cleo's PCLAN. But its inability to reconfigure the keyboard and the lack of some important information in the manual will cause problems for inexperienced users.

The PCLAN's NETBIOS compatibility makes it stand out in the crowd. If you aren't running a NETBIOS-compatible LAN, it won't be that useful because you won't be able to hook up any extra terminals. You could get the same functions with a real IBM 3275 for less money.



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LOOK at another file (and even edit it) from your graphics package. SEARCH for any file name or lext within a file without leaving your data-

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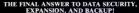
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take command.



■ MICRO TO MAINFRAME

PC/3270BC

The PC/3270 from Emuke Persyst comes in two parts that cover, between them, a wide range of possible 3270 configurations: the PC/3270BC and PC/3270BT. The BC portion (which we tested) is a cluster controller emulator, used with the Persyst DC/PS8 card, that provides 3274 model 51C emulation for up to four other PCs. The BT portion runs with the PCP/SS MPC board and connects with the PCP/SS MPC board and connects with the CPCP/SS board to emulate the 3278 Model 2 or 3279

The file-transfer capabilities of the PC/3270BC only allow

screen capture to disk or to the printer.

Model S2A/S2B display. To get IBM 3287 printer emulation, you use printers connected to either the cluster controller PC or a slave PC.

The DCP/88 board has two "cliffnage,"—

The The The The Proys use to be scribe a bracker that fits horizontally over the other brackers at the back of the PC. Each cliffnager holds two connectors, and a pointer. The cliffnagers don't take up so the additional PCs and a printer. The cliffnagers don't take up slots and wort really get in the up slots and wort really get in the suspect most users won't bother house the suspect most users won't bother house the my left them up and will let them dangle behind the PC.

The manual's section on getting stated deals with the fundamentals of instaldamentals of instaldamentals of instaldamentals of instaldamentals of instaldamentals. It will surely be a welcome sight to users used to manuals that assume you allow the work of the know where to start. You get two separate manuals for the DCP88 card: an installation manual with good technical detailst and a diagnostic manual. The diagnostic manual is a little out of date, but an up-todate version of the manual is included and staff properties. The start of the control of the diagnostic disk called DCP-USER DOC.

You should print the helpful README

file on the emulation disk before installation to check for known problems and useful comments that did not make it into the last printing of the manual. The only problem with this approach is that the README file is not referenced anywhere, so it's all too easy to miss out on this important information.

FILES The file-transfer capabilities only allow screen capture to disk or to the printor Compared with some of the other products I tested, this is a primitive way of transferring data. Screen images can be sent to the printer from the keyboard, but capturing to disk requires you to switch to local mode with the hot key. You might want to use this product with a sophisticatof PC-0-mainframe application and foreat about the builtie in file capture canabili-

ties.

The keyboard is reconfigurable, and the reverse side of the keyboard template gives you space to indicate the changed configuration. I was glad to see that the keyboard could be reconfigured because the PA keys on the default keyboard configuration did not work. I called the vendor, and we determined that someone had changed the keyboard configuration before I tested the



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ther utilities measure available file space, test your disk for damage, and measure your computer's performance. PC Magazine calls The Utilities "Indispensable." The New York Times says "Don't compute without it." Peter McWilliams (The Personal Computer Book) says "You'll bless this disk." Dozens of features keep your data in line. Every day.

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DATA RECOVERY DISK MANAGEMENT

A life saver for your data.

■ MICRO TO MAINFRAME

FEDITOR'S CHOICE

In a category like emulation boards. the products themselves tend to be so similar that a few interesting features can go a long way to distinguish one package. In this group, Pathway Design's pcPath Communications Package was the one that caught our eve

Its concurrent-sessions capability, rarely seen on a bisync board, is a real crowd pleaser. But the quality of the rest of the package is impressive as well. We were particularly impressed by the exceptionally lucid and well-designed documentation This attention to detail is consistent throughout the pcPath Communications Package.

Two of the features in local ("hot key") mode allow you to access help functions. Standard system help is available, as well as user-defined help. User-defined help, in conjunction with keyboard changes, allows technical people to partially customize this product to each user's needs

While running the PC Magazine Labs tests, I noticed that I could enter alphabetic data into numeric fields. I called the vendor with this problem and found that I was using an unreleased version of the emulation software. This problem should not occur with released software.

Emulex Persyst's emulation package is a good choice for both experienced and inexperienced users. Nothing here is too technical for novices to cope with, and experienced users may enjoy playing with multiple stations and keyboard reconfigurations. - Charles Teets

Bill Harts is a contributing editor of PC Magazine. He is the president of Open Communications Inc., a Melville, New York-based communications consulting firm. Charles Teets is president of TCT Consulting, a New Jersey-based PC communications consulting firm, M. David Stone is a frequent contributor to PC Mag-



PRODUCTIVITY

■ PC LAB NOTES: HARD DISK PERFORMANCE ■ WINN L. ROSCH

More speed from HARD DISK DRIVES

By reorganizing your files to optimize the interaction between DOS and the head actuator, you can make your system run substantially faster.

If you've been putting your hard disk to good use, odds are that it's not as fast as it used to be. As soon as you start to use it, a hard disk's performance begins deteriorate, and the more use it gets, the more slowly it is likely to respond. Indeed, even if it's brand new, it may not be performing at its peak efficiency.

This speed loss can at least be minimized if you understand why it occurs. In fact, by implementing the suggestions I'll be presenting here, you can make your hard disk as fast as new—or even faster without Iffing a screwdriver.

Although the problem has a largely mechanical basis, you disk drive is not wearing out. Disk-drive hearings do not seize reing out. Disk-drive hearings do not seize reserved to the problem of the problem of the seize and sow down. Rather, the sluggishness that add sists develop is the result of an interaction between software—specifically your disk operating system, DOS—and the head actuator, the mechanism that and the seize of the served of the way your disk by capital gystem, DOS—and the best disk single system, DOS—of the served of the way your disk is organized and your files are managed by DOS.

By reorganizing your disk files to optimize the interaction between DOS and the head actuator, therefore, you can make your system run substantially faster—so much faster that you'll be able to see the difference when you load programs or data edifference when you load programs or data davanced ricks to make your hard disk seem to perform faster than its mechanical timits would allow.

FILE SCATTER One major cause of the disk speed degradation that occurs as hard disks are used is DOS's method of packing lifes onto any disks, hard or floppy. While the files on it your disk vary widely in length, DOS divides each one of them into a group of fixed-length "clusters." While the precise number of bytes in a cluster the precise number of bytes in a cluster wersion, whether the specific cluster size of the control of the disk of the d

PRODUCTIVITY INDEX

PC LAB NOTES
Eliminating fragmentation and using caching to improve hard disk performance.

PROGRAMMING/UTILITIES
Implementing different formats and
fonts with the EGA.
SPREADSHEET CLINIC
Faster loading, title editing, and Ganti

charts with Lotus's 1-2-3.

POWER USER
Importing 1-2-3 files into dBase III,
and using SideKick in accounting.

USER-TO-USER

Finding binary file text, protecting hard disks, and reset switches. PC TUTOR Printing sideways on an Epson. The potential slowdown occurs because DOS does not require (some operating systems do) that the clusters comprising a given file be physically contiguous on the dustract. In other words, in order to assemble the relevant clusters for a file in proper sequence, DOS may have to tell the head actuator to move the head to many different physical locations on the disk.

WHO'S ON FIRST DOS uses a kind of map of the clusters on the disk—called file allocation table (FAT)—to keep track of which clusters are used by each file. In picking which clusters are to be assigned to a new file. DOS versions 1.x and 2.x follow a simple rule: the first available cluster, the one nearst the beginning of the complete the co

to the control of the

■ PC LAB NOTES

face. A file made up of widely scattered clusters is said to be "fragmented."

While it's easy for DOS to chain together a sequence of different clusters. Figurented files are a nightmare for the disk drive. The read/wrive head jumps all over the disk, shuttling between scattered clusters. Every head motion wastes time, and the more scattered the clusters are, the more slowly the drive performs. While the more slowly the drive performs. While the problem of Figurentiation is somewhat alleviated in DOS 3. x, it invariably happens in the course of hard disk tise.

To add so the problem, fragmentation also makes recovery of inadvertently erased files (using programs such as The Norton Utilities) chancier or even totally impossible. To find erased date, those programs took at the first advailable for the substitution table and select the first advailable for the substitution to the substitution of a file were scattered before it was erased, however, the guesses made by file recovery utilities are often wrong.

Although most file recovery programs allow you to use a manual mode to select the clusters to be undeleted, in which you preview the text contained in the file, this method is usually unsuccessful for nontext files. Scattering the clusters of a program can thus make it unrecoverable.

BACKUPS HIDDEN BENFETT Considerations both of speed and recoverability argue that it is best if all the clusters that constitute a file be cortiguous, as they are when written to a new (or newly formatvides no built-in method for rearranging clusters into a continuous sequence, you and not pick yourself, either by using special software (see sidebar "Fine-Tung (your Hard Disk") or by using your hard disk backup system (streaming tape, and the pick your properties of the pick of hard disk backup system (streaming tape, and reseave was treaming tape, and the pick files, on and reseave was treaming tape.

The first alternative is easier and faster and doesn't require your continued attention, as does backup to floppy disks, for example. The second alternative, of eourse, gives you a backup copy of your data—one you might never have made. (Human nature being what it is, most people don't think about the importance of

FINE-TUNING YOUR HARD DISK

Cluster reorganizers improve file-access speed without disk backup.

Two commercial programs reorgamize the clusters of disk files and make them contiguous to speed disk access without the need for backing up and restoring disk files. Both programs use scentially the same methods to achieve their results: they temporally copy clusters that the contiguous clusters, then copy the files back to the contiguous clusters. Thus both programs require at least some free disk space to operate, and both run faster when more disk space is available.

Disk Optimizer, from SolfLogic Soluions, includes four functions. One efficiently reallocates clusters to make files cordiguous on your hard or hoppy disk. when uses he recognitation is advantage cours. The program package also includes a file security system that will lock files so that other people cannot pry into them (and, of course, unlock them so you can use the files as well as a byte editor that allows you to modify any byte any that allows you to modify any byte any conveniently have with DEBUC.

Disk Optimizer has a well-written, typeset manual that's clear enough even that novices should have no problem with the program. Its only limitation is that it cannot handle subdirectories more than 30 levels deep. In practice, that should prove to be no limitation at all.

CLUSTER-CONTIGUOUS FILES Disk Organizer, abbreviated DOG by its creator, G. Allen Morris III, goes beyond

Disk Optimizer in allowing you to finetune your hard disk. It also allows you to specify how to arrange the cluster-contiguous files on your disk. Thus, you can put DOS commands and your most-often-used applications as close to the FAT

as possible to minimize head movement. DOG has four operating modes: one for quick disk clean-ups; one that puts flies and their clusters in the same order that they are found in your disk directory; one that packs flies contiguously but in the same order that they were originally on the disk; and one that puts all the files that were originally contiguous as close to the FAT as possible.

These contiguous files are the ones that change the least, so this mode helps further speed disk performance. You can override DOG's selection of which files to pile next to the FAT by specifying a specific way of organizing specified files in a special command file.

The principal limits to DOG are a maximum of 32,000 clusters on the disk (well in excess of the number on any standard DOS disk) and 2,000 files in any single directory.

DOG is available as shareware. The author allows an evaluation version of the program to be distributed free, typically by computer clubs and bulletin boards. If you like the program, send money to the author. The manual is distributed on disk with the program and is a bit rough, or "raff," according to its author. Nevertheless, DOG is a faithful companion—Whan I. Roced.

data backup until after they've lost the contents of a hard disk for the first time.)

THE BACKUP ALTERNATIVE If you opt for the backup technique, the crucial point is to make the backup copy of your hard disk one that will be restored file by file rather than sa disk image or 'minro'' copy. The DOS COPY *.* command does this automatically. COPY will not automatically ack up files in subdirectories.

however (you must use CHDIR to get at them), and if you re backing up to floopy disks, CQPY is limited to what you can put on one disk. If you have 30 files in a sub-directory and only the first 5 will fit on a single floopy, you're going to be typing a too f individual flemanes to back up the remaining 25. The way to get around this to tue septical-projects editor Johan Disk-inson's BAC COM utility (Programming).

FREE SOFTWARE, ANYONE?

Utilities for driving your hard disk harder from PC Magazine's IRS.

The best software isn't always the couties, especially in the capecially in the copy of programs written for PC Magazine and available through our Interactive Reservice. Designed to improve upon DOS commands, these programs will the programs will acknow a command to the programs will acknow a more versatile. For the programs come and more versatile, For the programs directly, the programs can be keyed in directly from the proper issue of PC Magazine.

Here is an overview of some of the programs that are especially helpful at increasing your hard disk's efficiency:

VTREE (Programming/Utilities, PC Magazine, Volume 4 Number 22) does what the DOS command TREE should have done originally; it visually displays the tree structure of your hard disk's subdirectories.

CACHE (Programming, Volume 4 Number 16) creates a disk-cache system that effectively replaces mechanical drives with an on-line cached pseudo-RAMdisk.

SWEEP (Programming/Utilities, Volume 4 Number 23) runs your DOS commands through all the subdirectories on a hard disk. For example, SWEEP DEL *.BAK deletes backup files from every subdirectory.

PUSHDIR and POPDIR (Program-

ming/Utilities, Volume 5 Number 10) act together. PUSHDIR accesses a program in any subdirectory from any subdirectory; when you are finished, POP-DIR returns you to the original subdirectory.

NO. COM (Programming/Utilities, Volume 5 Number 9) acts on all files but the ones specifically excluded. For example, NO *.BAS DEL *.* deletes all but your BASIC files; NO *.COM NO *.EXE DIR lists all but your .COM and

EXE files.

ATTR.COM (Programming/Utilities, Volume 5 Number 11) alters file attributes. Using this, you can create readonly files, hidden or system files, and

more.

DISKSCAN (Programming/Utilities,
Volume 5 Number 8) checks your hard
disk and warns you when bad sectors begin to form, giving you time to save what

has to be saved.

To get these programs using a modem, call the IRS at (212) 696-0360, using 1,200 or 300 bits per second, with 8 data bits and 1 stop bit, no parily. If you don't get through at first, keep trying (set your communications program to autoredial). Even with 18 lines, not all calls ext through the first time. Also, all calls

go in through the same line; don't try di-

aling one number higher. - David Gray

which you can download by modem (no time involved, this has the disadvantage charge) from our Interactive Reader Serthat until restored, the files backed up usvice at (212) 696-0360 or type in from the ing BACKUP can't be read directly. Inmagazine. BAC.COM allows you to deed, if the floppy disks onto which you're change disks as required during the copybacking up (which must be formatted, but ing operation. Just have a supply of forneed not be blank) themselves contain mematted blank disks ready when they are dia flaws, your BACKUP files may not called for. The only real limitation on useven be RESTOREable. If you use the ing COPY *.* or BAC.COM is that no DOS BACKUP and RESTORE facilities, single file can exceed the 360K-byte limit therefore, I recommend that you make (1.2 megabytes if you use an AT's drive more than one BACKUP copy. Allow 25 A:) of a floppy disk. formatted floppies per 10 megabytes of If you want to back up subdirectories as hard disk.

you go or you need to back up files larger than a single floppy can hold, you can use the DOS BACKUP utility. Apart from the

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software library. It produces output that is really quite remarkable. Lettrix is also extremely easy to use. Even the program's documentation is a pleasure." - PC MAGAZNE

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■ PC LAB NOTES



FACT FILE

EXTENDED DOS SERVICES DOS2ools, Version 2.1B F-X-F Software Systems 8855 Atlanta, #298 Huntington Beach, CA 92646 (714) 662-2535

List Price: \$99 Requires: 128K RAM, DOS 2.0 or bier

In Short: A comprehensive collection of more than 35 utilities, including all the basics plus useful programmers' tools like switching video pages. Selected as Editor's Choice (see "Extending DOS's Utility," PC Mazazine, Volume 5 Number 9).

Not copy protected. XTREE, Version 2.0 Executive Systems Inc. 15300 Ventura Blvd., #305 Sherman Oaks, CA 91403 (800) 634-5545 (818) 990-3457

List Price: \$49.95 Requires: 192K RAM, DOS 2.0 or

In Short: XTREE allows you enormous flexibility in using its file-management operations, while remaining easy enough for novices. Selected as Editor's Choice out of a field of 16 (see "Extending DOS's Utility," PC Magazine, Volume 5 Number 9).

Not copy protected. CRCLE 637 ON PEADER SERVICE CARD

MENUING SYSTEMS PreCursor, Version 2.0 The David L. Aldridge Co. Inc. 340 Town and Country Village Houston, TX 77024 713) 464-7465 List Price: \$69.95

Requires: 64K RAM, DOS 2.0 or In Short. Automates menu design and offers printer setup, predefined DOS commands, and auditing of time spent in applications. PreCursor is an excellent program with truly useful features. Selected as Editor's Choice (see "Menu Generators: DOS Made Easier," PC Masazine, Volume 5 Number 11). Not copy

protected CIRCLE \$36 ON HEADER SERVICE CARD Peter Norton Computing Inc. 2210 Wilshire Blvd., #186-D Santa Monica, CA 90403 (213) 826-8032 List Price: \$75

Requires: 256K RAM: hard disk In Short: Norton Communder allows a user to jump through the disk, execute files by pointing (with mouse or cursor), and perform "sweep" functions such as moving and copy-

ing files or howsing through groups of files. Not copy protected. CIRCLE (08 ON READER SERVICE CARS Direct Access, Version 4.0

Delta Technology International P.O. Box 1104 Eau Claire, WI 54702 (715) 832-0958 I let Price SNO OS Requires: 128K RAM, DOS 2.0 or

later In Short: Direct Access has all the features you'd want, and they all work well. Amone other assets, it extends DOS's batch processor and pr duces usage reports. Selected as Editor's Choice (see "Menu Generators: DOS Made Easier," PC Magazine, Volume 5 Number 11). Not copy protected.

OLE 634 ON READER SCRIVICE CARD Hard Desk, Version I.0 Modtech

10933 Crahapple Rd Roswell GA 30075 (800) 223-6250 List Price: S95 Requires: 128K RAM, DOS 2.0 or

In Short. While Hard Desk is primarily a menu generator, it includes a file manager, a macro facility, a cutand-paste facility, and a means of appending descriptions to the filenam in a directory. It is easy to install and

use, but it suffers from a 15-entry limit. Not copy protected. CIRCLE 633 ON FIEA

Idir. Version 3.5 Bourbaki Inc. 615 W. Hays St Boise, ID 83702 (208) 342, 5849 List Price: \$95 Requires: 192K RAM, DOS 2.0 or

In Short: Primarily a menu generator and batch builder. Idir is intended for users who already have extensive batch files. Not copy protected. CROLE \$11 ON PEADER SERVICE CARD

Pathminder, Version 3.0 Westlake Data Corp. P.O. Box 1711 Austin, TX 78767 (512) 474-4666 List Price: S39.95 Requires: 256K RAM, DOS 2.0 or

In Short: A 4K program with enough features to make other utilities superfluous. Not copy protected.

FILE RECOVERY The Norton Utilities, Version 3.1 Peter Norton Computing Inc. 2210 Wilshire Blvd., #186-D Santa Monica, CA 90403 List Price: \$99.95

Regulres: 64K RAM, one disk drive, PC-DOS. In Short: A collection of DOS utilities featuring both a quick UnErase utility and a more extensive file-recovery method. It's still the best (see "Norton Utilities: Still the Best? PC News, page 54, PC Magazine, Volume 5 Number 3). Not copy pro-

tected. CIPICLE 632 ON READER SERVICE CARD File Recavery System Brown Bag Software 2105 S. Bascom Ave Campbell, CA 95008

(408) 559-4545 List Price: \$69.95 (copy protected); \$89.95 (not copy protected). Regulres: 128K RAM, one disk drive DOS In Short: File recovery combined

with drive management and control functions. Optional copy protection. CIRCLE 631 DN READER SERMOT CARD.

PC Tools, Version 2.0 Central Point Software 9700 SW Capitol Hwy., #100 Portland, OR 97219 (503) 244-5782 List Price: \$39.95 Requires: 128K RAM (64K RAM

for RAM-resident mode), one disk drive, DOS 2.0 or later. In Short: RAM-resident utilities similar to The Norson Unlines. The package also provides a menu-driven DOS shell for simplifying disk management, PC Tools now has full support for the 31/2 inch drive. Not copy protected NOLE 630 ON READER SERVICE CARD

FILE PATH FINDERS FasyPath. Polygon Software Corp. 330 Seventh Ave. New York, NY 10001 (212) 967-2424 List Price: \$100 Requires: DOS 2.0 or later. In Short: A powerful and diverse program that is designed primurily for the experienced user. Not copy protected.

CIRCLE #24 DN READER SERVICE CARD FilePath, Version 3.03 SDA Associates P.O. Box 36152 San Jose, CA 95158 (408) 281-7747 List Price: \$37.50 Requires: 64K RAM, one disk drive, DOS 2.0 or later In Short: FilePath finds nonexecutable files located in another directory. Not copy protected. CIRCLE AND ON READER SERVICE CARD

File Facility IBM Personally Developed Software P.O. Box 3280 Wallingford, CT 06494 (800) IBM-PCSW List Price: \$19.95 Requires: DOS 2.0 or later. In Short: File Facility extends the power of the PATH command to read and write files to any drive or directory. Not copy protected.

artPath, Version 1.1 Software Research Technology 2130 S. Vermoni Los Angeles, CA 90007 (213) 737-7663 List Price: \$29.95 Requires: DOS 2.0 or later. In Short: SmartPath extends the DOS command PATH so as to be able to find any type of file in any directory. Not copy protected.

CIPCLE 606 ON READER SERVICE CARD

BACKUP SOFTWARE Backtrack, Version 2.0 Tallerass Technologies Corp. 11100 W. 82d St Overland Park, KS 66214 (401) 274-0393 List Price: \$129 Requires: 256K RAM, hard disk drive, floppy or additional hard disk In Short: Backtrack allows different configurations and times for backup ons, but it tends to be st hungry. Copy protected for all versions made prior to July 15.

Take Two, Version 1.05 United Software Security Inc. 8133 Leesburg Pike, #800 Vienna, VA 22180 (800) 892-0007 List Price: \$165; copy-protected sion, \$115 Regulres: 128K RAM, hard disk drive, floppy disk drive In Short: One of the best menu-driven backup programs. Take Two offers speed and a variety of options. Optional copy protection.

CIRCLE BAY ON READER SERVICE CARD

Tall Tree Systems 1120 San Antonio Rd. Palo Alto, CA 94303 (415) 964-1980 List Price: \$60 Requires: 128K RAM, two floppy In Short: A command-driven trans fer utility that comes with the Jer-Drive RAMdisk, Jet offers flexibili ty, reliability, and unique backup ions. Not copy protected. options. Not copy protecteu. CIRCLE 622 ON READER SERVICE CARD

Jet, Version 3.3

DataCare, Version 1.5 Ellicott Software Inc. 3777 Plum Hill Ct. Ellicott City, MD 21043

(301) 465-2690 List Price: \$99 Requires: 128K RAM, DOS 2.0 or

In Short: This faster-than-average backup program offers three very useful utilities. Not copy protected ORCLE 822 ON READER SERVICE CARD KeepTrack Plus, Version 1.1 B

The Finot Group 2390 El Camino Real, #3 Palo Alto, CA 94306 (800) 628-2828, ext.700 (415) 322-6161 List Price: \$79, plus \$5 postage and Requires: 256K RAM, hard disk drive, floppy disk drive.

In Short: Combines backup and extended DOS services with an easy-touse interface. Not copy protected CIRCLE 601 ON READER SERVICE CARD TEXT RETRIEVAL SYSTEMS IN-SIGHT, Version 2.02 soft Inc

P.O. Box 638 Wilsonville, OR 97070 (503) 682-3636 List Price: \$95 Requires: 256K RAM, two disk ives, DOS 2.0 or later In Short: This information retrieval system finds documents by word, tion. IN-SIGHT is an elegant, worth

phrase, or matching letter combina while product. Not copy protected CITCLE 620 ON READER SERVICE CARD Electra-Find O'Neill Software P.O. Box 26111 San Francisco, CA 94126 (415) 398-2255 List Price: \$52 Regulres: One disk drive; with DOS 2.x, 64K RAM; with DOS 3.0 or later. 96K RAM. In Short: A text-retrieval system that works on existing ASCII files without indexes or special formatting. Not copy protected.

CRICLE 619 ON PEADER SERVICE CARD

FY | 3000 Plus Software Marketing Associates Inc. 4615 W. Bee Caves Rd. Austin, TX 78746 (512) 327-2882 List Price: \$395 Requires: 128K RAM, two 390K floppy disks or hard disk. In Short: An updated version of an old reliable. FYI 3000 Plus indexes

text files and locates documents based on word searches. Not copy CIPICLE #1# ON READER SERVICE CARD ZyINDEX Professional Zvl.AB Com 233 E. Erie St Chicago, IL 60611 (312) 642-2201 List Price: \$295 Regulres: 256K RAM, one disk drive, DOS 2.0 or later. In Short: A lexical file n performs word-oriented searches on

text files produced by word proces

sors or on spreadsheet or datab

print files. Not copy protected.

CROLE 817 ON READER SERVICE CARD

MISCELLANEOUS SmartNotes, Version 1.1 Personics Corp. 2352 Main St., Bldg. 2 Concord, MA 01742 (617) 897-1575 List Price: \$79.95 ires: 90K RAM in addition to DOS and other programs. Most useful when running on machines with 256K RAM or mor In Short: Memory-resident utility that enables you to annotate any screen or file, including directory listings, much as you would use Post-

its on paper. Similar to Note-It but not limited to 1-2-3. Not copy pro-CIPICLE #18 ON READER SERVICE CARD

Lightning, Version 4.2 Portable Computer Support Group Inc. 11035 Harry Hines Blvd., #206 Dallas, TX 75229 (214) 351-0564 List Price: \$49.95 (copy protected);

\$89.95 (not copy protected)
Requires: 256K RAM, DOS 2.0 or In Short: Improves DOS disk access times with disk-caching capability. Works well when cache size is larger than the average with which the program is working. Copy protection

RCLE 616 ON READER SERVICE CARD Disk Optimizer SoftLogic Solutions Inc. 530 Chestnut St. Manchester, NH 03101 (800) 272-9900 List Price: \$49.95 Requires: 128K RAM, DOS 2.0 or

In Short: Repacks a disk so that all files are stored contiguously. This minimizes the amount of head movement, resulting in faster disk access-

es. Copy protected. CIRCLE 614 ON READER SERVICE CARD Disk Organizer Soft GAMs Software G Allen Morris III 1411 10th Ave. Oakland, CA 94606 List Price: Available free; \$20 license fee requested Requires: DOS 2.0 or later. In Short: A program that will opti-

mize the placement of individual files to minimize disk drive head movement. Not copy protected. CIRCLE 619 ON READER SERVICE CARD

Software Masters 6223 Carrollton Ave. Indianapolis, IN 46220 (317) 253-8088 List Price: \$49.95 Requires: 128K RAM, DOS 2.0 or later

In Short: A disk-caching program that makes use of regular system RAM; has the ability to keep certain data permanently in the cache. Not CODY protected.
CIRCLE 612 ON FIEADER SERVICE CARD

tected

GET THE MOST FROM YOUR HARD DISK

Path finders, extended DOS services, recovery utilities, and menuing systems help you navigate through your disk. But time savers for some are time wasters for others.

Maintaining a hard disk is like keepking up a house; you have to clean it, insure it, and try to increase its value. To accomplish those tasks, you need proper tools; on a hard disk, tools translate to utilities. While DOS and a bit of ingenuity can get you by (as explained in Winn L. Rosch's "More Speed from Hard Disk Drives"), extra tools never hurt, and the more specialized the tool, the greater the increase in productivity.

Here is a summary of products that help you optimize the utility and performance of your hard disk. They don't make the disk work faster, but you do—you're better organized and more in control. Because of the abundance of products, we're mentioning only some of the best examples in each category.

BACKUP Backup is the only absolutely necessary task. Your work is useful only if it's accessible. If the drive goes down and you have no up-to-date backups, you go down also.

There are two basic types of backup software: transfer utilities and backup/restore programs. (For a complete roundup, see "Software Safety Nets for Hard Disk Data," PC Magazine, Volume 5 Number 14.) Transfer utilities work much the same as the DOS COPY command: You call the utility, designate the source and target from the command line, and follow any on-screen instructions that appear. Because the utility is transferring the files, backup and restore operate in the same manner. Tall Tree Systems' Jet, a utility within the JetDrive RAMdisk package, is more than representative, offering reliability, power, and flexibility.

If you prefer menu-driven software, you should investigate the dedicated backup and restore programs. Unlike most transfer programs, backup programs automate much of the process, in-

cluding such procedures as searching for newly created or updated files, requesting the insertion of a specific tape or disk volume, and keeping a log of each session. Two of the programs PC Megazine though highly of in the Volume S Number 14 roundup are United Software Scurity's Take Two and Ellicott Software's DataCare. If your system includes two flooply drives, you might includes two flooply drives, you might comply a process of the programs of the Copy, is recently unprotected Backrack.

(For more on the fundamentals of disk

background processing.

■ If the drive goes down and you have no up-to-date backups, you go down also.

backup, see "No Backups Means Going in Reverse," PC Lab Notes, PC Magazine, Volume 5 Number 11. Tape backup units were reviewed in Volume 5 Number 3 and Volume 5 Number 13.)

RECOVERY PROGRAMS It is very easy to use the DOS DEL command with wildcards and then realize you erased half a dozen vital files. That's where file recovery programs come in. While the selling point of these programs is file recovery, they also include tools for viewing and changing files, finding files, searching for strings in text files, and wiping out—permanently erasing—files.

If you can have only one recovery program, The Norton Utilities is the one to get. It was not only rated the best overall

in a recent article (see PC News, page 54, "Norton Utilities: Still the Best?" PC Magazine, Volume 5 Number 3), but it also has the advantage of being the standard; when you've lost a file, you can usually get the help of a coworker or friend to guide you through the recovery process. Other utilities in The Norton Utilities package are a boon to hard disk users: File Find locates a file anywhere in your hard disk as long as you know at least part of the file name; Text Search helps you locate a file if you can remember a phrase in the file; Disk Test tests a disk for damage and marks bad sectors so that they can't be used: Directory Sort reorganizes directories by file size, name, extension, or date. Your disk doesn't work faster, but you do.

Another well-thought-of recovery program is Central Point Software's PC Tools. It combines Norton-like utilities with extended DOS services

EXTENDED DOS SERVICES Extended DOS services are those utilities Microsoft and IBM should have included with the disk operating system. They help you organize and maintain your directory hierarchy by simplifying the housekeeping process with MOVE and TAG commands and easing the transition into subdirectory use with graphics trees. Among the best (see "Extending DOS's Utility," PC Magazine, Volume 5 Number 9) are Executive Systems' XTREE and E-X-E Software Systems' DOS2ools. The former combines a visual approach with control sequence commands to provide exceptional power and flexibility. The latter comes with tools for the system and program developer.

MENUING SYSTEMS If you need to standardize the interface on the computers in your company, you might consider Peter Norton's new Norton Commander. Westlake Data Corp.'s Pathminder, and Bourbaki's 1dir. While they primarily extend DOS's commands, they also provide menus for easier access to your applications.

If you need a full-fledged menu generator, there are Delta Technology International's Direct Access and The David L. Aldridge Co.'s PreCursor. Both of these packages provide menus, relatively easy installation, and a means to track usage without imposing obstacles that slow up productivity.

Not everyone finds menuing systems a benefit. For more-experienced users, the extra layer of insulation between you and the applications programs you want to run may slow you down in the long run. Think of menuing systems as training wheels.

PATH PROGRAMS The DOS PATH command lets you execute program (.COM and .EXE) files and batch (.BAT) files from any directory in your PC, even if the file isn't in the current directory. Commercial path programs extend that ability to all programs, including those requiring overlay or belp files (WordStar, for instance).

Path utilities wait for a program to call an auxiliary file and then go out and lo-

Using a path program requires discipline, though, Because you can suddenly run, for example, WordStar in any directory, you will be creating files in that directory. Path programs aren't smart enough to know that even though you're in your \123 subdirectory, you really want your WordStar memo to be in your \TEXT subdirectory. So you have to remember to move the file when you are finished. A future PC Magazine article will look into path programs. In the meanwhile, you might consider SDA Associates' FilePath, IBM's File Facility (a bargain at \$19.95), and Software Research Technology's SmartPath.

DISK CACHING There are two ways you can speed disk input and output: by using caching programs and by optimizing the file storage. A cache program, such as Software Masters' Flash or PC Magazine's own CACHE, will speed access time because the processor is actually reading and writing to RAM rather than disk. But data can be lost if the cache is not flushed

before you power down.

An optimizer speeds access time because it remaps your files in contiguous sectors—the constant crasting and creating of files fragments files—and when they do not have to jump to different sectors. While you can remap your hard disk by backing up your files, reformating the drive, and then restoring the files, dedicated programs such as Soft-GAMs Software's Disk Organizer (GAMs Software's Disk Organizer

ON-SCREEN NOTES DOS allows only 11 characters to label a file. Programs such as Personics Corp.'s Smart-Notes and Modtech's Hard Desk let you append longer on-screen comments about files for additional information.

SmartNotes (see PC News, page 46, "SmartNotes: Like Electronic Post-Its;" PC Magazine, Volume 5 Number 13) has broader applications, such as explaining cells in a spreadsheet, but it also works well in hard disk directories

CATALOG PROGRAMS It is always nice to be able to archive your least-used data files and still maintain, on your hard disk, a record of their existence, contents, and location. One method is to use a catalog program, such as DISKCAT-5, which allows you to archive to off-line storage while still maintaining a log online. If you work mainly with documents, information-retrieval programs such as Electra-Find, FYI 3000 Plus, and PearlSoft's IN.SIGHT are essential for hard disk users. They maintain an index and a catalog of all your documents whether off- or on-line while providing access to their contents within a few keystrokes.-Vincent Puella

Vincent Puglia is a frequent contributor to PC Magazine.

ing the manufacturers' instructions. The BACKUP/RESTORE process can often render such software (Louis's 1-2-3, for example) unusable if you don't. This is yet another reason why copy-protection schemes are falling into such disfavor.

A CLEAN SLATE Just to be safe, you may want to make two backups of your data (especially if you use the DOS BACKUP program) because the next step—optional but recommended—is to reformat your hard disk. The formatting process wipes the disk clean of your original files and gives DOS an effectively new disk on which is never over the disk central but the program of the program of

disk on which to restore your files. The very idea of reformatting is frightening when you have megabytes on the line, but if you have adequate file backup and have safely uninstalled any copy-protected software, it should cause no problems. When DOS formats a disk, it automatically finds any bad clusters and flags them so that they will not subsequently be used for reading and writing data. As a double check, if you have the Advanced Diagnostics Disk (which does not come with DOS but is part of the \$195 IBM Hardware Maintenance and Service manual for your PC, XT, or AT), you may want to perform a "surface analysis" at this point. Alternatively, The Norton Utilities contains a disk-checking program, or you can use Charles Petzold's DISK-SCAN program (Programming/Utilities, PC Magazine, Volume 5 Number 8, also available by modern from PC Magazine's

IRS). Once your hard disk is reformated, simply copy all your files back to it using your backup system's file-by-file restoration option. During the restoration produced by the produced by

THE COMMERCIAL ROUTE Commercial disk-optimizing software will rearrange clusters without backing up. These programs work by temporarily copying

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data from one area of the disk to another, freeing up a contiguous area of clusters and copying the data back to the newly freed, contiguous clusters. At least one copy of your data is always recorded on the disk, and so you don't risk losing anything if the power fails or the system crashes during the optimization process.

ORGANIZATIONAL EFFERENCY TO get the utmost in disk performance within the limits imposed by the head-actuator mechanism, you need to go a step beyond simply ensuring contiguous file clusters. You may want to organize the orders in which your disk files are arranged so that your normal daily usage requires minimum head movement. If it is means copymous the continuous means of the property of the

If you're unfamiliar with this last. CONFIG.SYS is a file you can create and modify with an ordinary ASCII-style word processor (EDLIN, WordStar [in its nondocument model, and XvWrite are good examples), to which DOS looks during boot-up before it even gets to your AU-TOEXEC BAT file. A line (it could be the only one) in this file, BUFFERS = x(x may)be any number from 1 to 99), tells DOS how much of its memory should be devoted to instant-access informationsuch as the list of clusters in the FAT that constitute your file. Each buffer is 528 bytes long, and unless you change its value, the DOS default is 2 (1,024 bytes) or 3 (for the AT). The easiest way to see how it affects the speed of your hard disk's action, however, is to start by setting BUFF-ERS=1. (When you make any change in the CONFIG.SYS file, you have to reboot with Ctrl-Alt-Del before the change takes effect.)

With BUFFERS-1, time how long it takes to load a fairly substantial-size program and—just as important—watch the red light on your disk drive flicker. Increase to BUFFERS-5, then 10, and so on, and you'll see how much less head activity (the red light) is required. There is a point at whish adding more buffers will actually slow down operations slightly, and the nature of the programs you use regular-

DISK CACHES IMPROVE ON BUFFERS

Software Masters' Flash and Portable Computer Support Group's Lightning speed up disk access.

Decame DOS uses its disk buffers ininpet and output operations by using special programs that temporarily store or cache data read from your system's diskinder the store of the store than the store of the st

Flash, from Software Masters, allows, you to set aside as much regular system memory as you want for disk caching. The system can be installed at any time, not just when you boot up (as loading a BUFFERS command requires), and, as ong as Flash is the last memory-resident program you install, it can be removed without reboots.

Flash features a special status display, help as reems, a high-priority mode that keeps certain disk sectors permanently in the cache, and the ability to lock out any additional data from being added to the cache.

As such programs go, Flash is quite intelligent. For instance, when used with floppy disk drives, it can determine when

a disk has been changed so that write operations can't jumble disk data. It will also protect disks to prevent writing to them, should you want.

Lightning (not to be confused with Borland International's Turbo Lightning, a complexity different product), from the Portable Computer Support Group, can addier up to 1.5 mgalystes of disk information because it can use the expanded memory set up carefully distributed in the control of the Lous/Intel/Microsoft expanded memory septimization. On the other hand, you can specify a cache as small as you want—the default is 60K berset. (Under DOS 1.1.

Lightning can be loaded and unloaded from memory at any time (except under DOS 1.1), and its memory can be used for buffering any disk drive or switched between drives after the program is loaded. The only restriction is that you cannot change the amount of memory allocated to Lightning without unloading the pro-

the maximum cache size is 63K.)

gram.

Disks can be write-protected by Lightning, and the program recognizes when floppy disks are changed. Help is limited to a display of available commands. A statistics program shows how much Lightning is improving the performance of your system.—Winn L. Rosch

ly will determine this point. But it usually pays to err slightly on the larger than on the smaller side. A good general-purpose value to use with a hard disk is BUFF-ERS=20.

MOST-ACCESSED FILES. If the file information is colorer to the FAT, less head movement will be required and file access will thus be faster; it stands to reason the optimal strategy is to put the files that are most other nead as close to the FAT as possible. Since files you regularly write to tend to grow and get scattered, you're best off putting them nearest to the free space on the disk—as far from the FAT as nossi-

ble. Typically, these are data files.
The files that are most likely t

The files that are most likely to be the most often read and least modified in your system are COMMAND. COM, other DOS programs, the applications that you use most, and batch files that you regularly run. To put these files no your disk. first, you only need to make them the first ones you restore from your back-up procedure. (Remember to to reinstall any copy-protected programs if you use them a lot and they require frequent disk accesses.)

DRIVE PARTITIONING There's another complication. DOS is able to find devices, including disk partitions that are



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HIGH SPEED TAPE BACKUP NOW \$475

Alliance Technology of Sunnyvale, CA has broken the \$500 price barrier with a high speed, high performance streaming tape system able to back up an entire 20MB hard disk on an XTor AT computer in less

than five minutes for \$47 "Our 25MB and 60MB systems are high speed systems similar to those sold by Alloy, Everex, Maynard, Sysgen and Tecmar," said Technology president Alliance Jochen Schude. "We all buy the same hardware but Alliance's window oriented software is significantly more powerful than others. Our direct marketing channel is more efficient so the end user pays less than \$500 for features ordinarily selling for \$900 to \$1,500. Our technical support department is the very best."



"Our user prices are about the same as floppy tape systems from Irwin, Peachtree Technology, and Interdyne, but our backup time is dramatically faster and the hardware reliability is much greater."

The Alliance systems can do high speed image, partition, or file by file backups with read-after-write verify. "Our window oriented software utility is compatible with more systems, easier to use, and resembles Lotus '1-2-3 menu,' explained Schude. "Our tape controllers are short length cards, and the tape drives are 5.25 inch half height."

Alliance also sells a \$575 portable backup system similar to the Maynard Maynstream that can be moved from one office to another to back up any number of XT's and AT's. 60MB cartridge tape systems (similar to Everex's) are \$675.

25MB Streaming Tape Subsystem-\$475. 60MB Cartridge Tape Subsystem-\$675. (extra controllers \$139.)

Alliance Technology, Inc. 510 Lawrence Expy, Suite 210, Sunnyvale, CA 94086. (800) 621-0854 ext. 700 or (408) 727-6200. CIRCLE 499 ON READER SERVICE CARD

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given their own drive letter, faster than it can dig down into subdirectories. While DOS must search for subdirectories, it remembers where each root directory of each disk is. Unfortunately, however, unless your hard disk is from a third-party vendor that provides the necessary formatting software to allow you to partition a large hard disk into separate drive letters (for example, D:, E:, and F:) on the same physical disk under DOS, this tip is useless. FDISK doesn't allow this, and using SUBST to give drive letter designations to subdirectories will not enhance disk speed. DOS must still search through these subdirectories despite their drive letter designations.

THE COST OF CONVENIENCE It of the seems that everything you' do to enhance the convenience of using your hard disk degrades is performance. One particular case in point is the PATH command for programs (COM, EXE, and BAT files) it cannot find in the current directory. Whenever you ask DOS to man a program and it cunnot find it in the current directory. DOS searches through all the directory command you gave it or included in the AUTOEXEC BAT file.

The fewer paths you specify, the less mit takes DOS to zero in on the desired program. If you must specify more than one directory in a PATH command, put your most often used programs in the first directory specified. Better yet, if you can, specify different hard disks instead of directories. Best of all, keep your most often used commands on a high-speed RAM-disk emalator (like DOS VIDISK) and that RAMSiks first in your PATH com-

RAM DISAS VERSIS CACHING. Using VDISK hints at the ultimate way to speed up your hard disk. It eliminates mechanical head motion entirely by going electronic. Electronic disk emulators have a performance advantage over hard disks because they have no moving parts. Leccept for a few that are equipped with bast-up-operated backup, they're volatile: a power failure or system crash wipes the RAMdisk clean.

With disk buffering or caching (pronounced "cashing"), however, you can combine most of the speed advantages of disk emulators with the nonvolatility of conventional hard disks.

Buffers and caches are temporary storge areas sliced from RAM. Typically, more than you ask for its red from the dismore than you ask for its red from the disk into the buffer. Usually your next request for disk data will ask for the next data on the disk—exactly what is held in the buffer—and the data can be shifted from the buffer electronically without the need for reading from the disk again.

DOS has to guess at what data you'll want next; the only way of increasing the likelihood that it guesses properly is to increase the amount of information it holds in the buffer. The BUFFERS=20 line in your CONFIG.SYS file is a good starting point. The limitations of the BUFFERS

Using VDISK

eliminates mechanical head motion entirely by going electronic.

statement have inspired at least two companies to create disk-caching programs that use more-refined, more-efficient algonithms than DOS does (see sidebar "Disk Caches Improve on Buffers"). Using one of these programs in lieu of a BUFFERS command can substantially increase apparent disk performance in most systems.

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Winn L. Rosch is a contributing editor of PC Magazine.



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EXPLORING THE EGA, PART 2



Here are EGA utilities for multiple-screen formats and individualized fonts, together with a build-it-yourself attachment to the EGA Feature Connector.

In part I of this article IPC Magazine, Volume S Number 14), we began our exploration of IBM's Enhanced Graphics Adapter (EGA) by looking at video modes, video pages, colons, palettes, and borders. In this issue we Il be exploring fionts, the 512-character set, and different screen formats (such as the 43-time display), concluding with a brief introduction to the more complex topic of EGA graphics.

As in part 1, most of the programs presented here are in the form of DEBUG "script" files. To create executable. COM files, type the lines shown into a file with the extension. SCR. Then use redirection of standard input with DEBUG, thus:

DEBUG <filename.SCR

DEBUG will then automatically create the executable .COM file.

Most of these programs use BIOS calls and memory locations that are documented in the EGA Technical Reference. This manual is currently available as an update to the IBM Options and Adapters Technical Reference (IBM Part Number 6322509).

BACKGROUND ON FONTS As with the old Color Graphics Adapter (CGA), the EGA supports both text and graphics video modes. In text modes the ASCII cocked of the displayed characters are stored in video memory. The adapter hardware translates these characters into dost stored in video remony. The adapter hardware translates these characters into dost through the use of a font table that contains the dot patterns for all 256 characters. In

stored in memory, and the adapter hardware simply translates these dots into video signals. For programs that need display only normal text, text modes are preferable because they require less video memory and can be manipulated more rapidly by anolications programs.

The CGA and the IBM Monochrome Adapter use a font table stored in ROM on the adapter board. This ROM is not accessible from software, and programs may not load a different font in text modes. The notly way to change the forth is to remove the ROM chip from the adapter board and substitute your own. These adapters are also generally limited to 25 lines of text on the screen. (The 6845 CRT Controller chip

on these boards can be programmed for a 50-line interlace mode, but it looks awful.) The EGA text modes work a little differently. The adapter memory contains both the font table and the ASCII codes of the displayed characters. The EGA BIOS

■ The EGA text modes work differently from the CGA's. Following a video mode set, you can download your own font into EGA memory. downloads the appropriate font into the EGA memory when it sets the video mode. The fonts are stored in the EGA BIOS, and programs have complete access to them through a BIOS call that returns a pointer to the stored fonts. Following a video mode set, you can also call the BIOS to download your own font into EGA memory. At the same time, you can change the number of displayable character rows on the screen.

(Of course, in EGA graphics modes a program can write whatever dots it wants to the screen and could even create proportionally spaced fonts. In character modes you don't have quite this same flex ibility.)

The fonts used in EGA text modes have some limitations. The most severe restriction is that the width of each character is fixed at 8 dots. This includes the space between characters, so in most cases characters will be only 7 dots wide.

The character height, however, may range from 1 to 32 scan lines. The maximum number of displayable character rows on the screen is equal to the took number of displayable scan lines (200 for the old Color Display and 350 for the Monochrome Display and Enhanced Color Display) affinanced Color Display) affinanced Color Display) affinanced color Displayah (200 for Display) divided by the number of scan lines per character.

The EGA BIOS contains complete fonts for an 8 by 8 character set (8 scan lines per character) and for an 8 by 14 character set (14 scan lines). You can get the starting address of these fonts in the EGA BIOS by simple Interrupt 10h calls.

These fonts are stored in the BIOS in a simple format. The order of the characters

PROGRAMMING/UTILITIES

is sequential by ASCII code. Each character is defined by a series of bytes, with the number of bytes used by each character equal to the height of the character in scan lines. The first byte contains the dot patterns for the top scan line. The most significant bit of each byte corresponds to the leftmost dot of the character. The least significant hit is usually 0 to allow for the space between characters. Thus the character box is 8 dots wide, while the characters are generally 7 dots wide. The lineand box-drawing characters (ASCII codes C0h through DFh) are 8 dots wide, so they connect on the horizontal.

(The Monochrome Display requires separate mention here, as its character box is actually 9 dots wide. For most characters, however, the 9th dot will be displayed as background. For the block- and linedrawing characters (ASCII codes from C0h through DFh) the EGA makes the 9th dot the same as the 8th dot, so the characters connect on the horizontal. The EGA

BB,82 AX,1138 ; Get 8x14 font : Returns ES:BF ; DS:S1 points to font ES:DI = destination Number of characters MAINLOOP: Call SHIPPRIGHT Call SHIPPRIGHT Call SHIPPRIGHT Call SHIPPRIGHT BP,0159 DX,DX CX,0100 Character count Bytes per character Block to load Terminats SEIFTRIGHT: SHIPTLEFT: end store

Figure 1. This EGAITAL program will change your EGA font to italic.

R CK

 You can use an 8-dotwide box with a 7-dotwide character for both the Enhanced Color and Monochrome Displays.

BIOS stores what is called a 9 by 14 font, but it is not a complete font. For all but 20 characters, the EGA uses the same 8 by 14 font used for the Enhanced Color Display. The 9 by 14 font contains alternative dot nattems for these exceptions. The storage format is different from that of the other fonts: Fach character requires a 1-byte AS-CII code, followed by 14 bytes for the dot patterns. The entire 9 by 14 font is terminated by a zero. This 9 by 14 font allows monochrome characters to be 8 dots wide, since the 9-dot width of the character box still leaves a space between characters. If you'll be creating your own fonts, however, you may want to forget about this peculiarity. For greatest versatility, you can use an 8-dot-wide character box with a 7-dotwide character for both the Enhanced Color Display and the Monochrome Display.)

In text modes that use 200 scan lines on the screen (video modes 0 through 3 when an EGA is connected to an old Color Display), the EGA normally uses the 8 by 8 font, putting 25 character rows on the display. Connected to an Enhanced Color Display or Monochrome Display, the EGA displays 350 scan lines, so the text modes (monochrome mode 7 and color modes 0 through 3) use the 8 by 14 font, again creating 25 character rows

However, if you use the 8 by 8 font in a 350-scan-line video mode, you can display 43 character rows, since 43 times 8 equals 344. A font that is 10 scan lines high (which can be the 8 by 8 font with 2 blank scan lines) allows 35 displayable rows. If you create your own 8 by 6 font, you can fit 58 lines on the screen

These alternative displays are supported by the EGA BIOS. What this "BIOS

stores the current number of lines per screen (less 1) at address 0000:0484h. An application can also obtain this information by an Interrupt 10h call. The BIOS Teletype routine (Interrupt 10h, Function call 0Fh), which is normally used for screen output at the DOS command level (except when ANSLSYS is loaded), uses this value to determine when to scroll the screen

FONT CHANGES THROUGH THE BIOS Even if you're not the type of person who would like to see everything on the screen in italic, it's well to begin by trying out the EGAITAL program shown in Figure 1. Create the EGAITAL SCR file. use DEBUG to turn it into an EGA-ITAL.COM file, and run it. Because it loads a 14-scan-line character font, this program can be used only with EGAs attached to Enhanced Color Displays or

Monochrome Displays. In EGAITAL, the first INT 10h call (where AX equals [130h) returns a pointer to the 8 by I4 font stored in the EGA BIOS. You can get a pointer to the 8 by 8 font by setting BL to 3, and to the 9 by 14 font extension by setting BL to 5. This function call also returns the current number of character rows (less 1) in register DL and the current number of scan lines per character (called "POINTS" in the BIOS

documentation) in register CX. Next, EGAITAL transfers the font to local memory and, in the process, shifts each byte to tilt the character to the right. (If you think that doing bit manipulations on existing fonts is a flaky way to create new fonts, that's how Microsoft Word does italics in EGA graphics modes, although Word uses a different algorithm that is not quite as extreme.) Finally, EGAITAL makes another BIOS call to load the font. This is Function Call 11h (in AH), subfunction 00h (in AL), which is

```
N HGASK14.COM
A 188
NOV AV. 15
                  Ax,1181 ; Load Sx14 font
BL,S ; Block to load
18 ; Call BlOS
 3 CX
```

Figure 2. EGA8X14 loads the normal 8 by 14 support" means is very simple: The EGA font into the EGA after you get tired of italic. PC MAGAZINE . SEPTEMBER 16, 1986



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used to load a user font when the number of displayable rows does not change. Although you're loading all 256 characters starting at ASCII code 00, you can load only part of a character set by setting registers CX and DX appropriately.

You can go back to the normal font by recetting the video mode with EGAMODE (a program shown in part 1 of this article) to by executing the program EGAMO to the control of the control of

Incidentally, when you execute these programs, you may see a hire footnetction of your display (and it may even roll over once) when the foot is loaded. This is normal. The EGA BIOS has to change the video mode to one of the internal modes to lead to the condition of the condit

CHANGING THE DISPLAYABLE ROWS The Interrupt 10h function calls used in the previous examples (where AH is 11h and AL equals 00, 01, or 02) simply load the font. When AL equals 10h, 11h, or 12h, the BIOS loads the font and recalulates the number of displayable rows on the screen based on the new character height.

The BIOS also recalculates the cursor



Figure 3. EGA43 changes to a 43-line mode and fixes the color cursor and monochrome underline.

When you execute these programs, you may see a brief contraction of your display when the font is loaded. This is normal.

and monochrome underline position, but it does so incorrectly, causing the cursor on an Enhanced Color Display and the underline on the Monochrome Display to disappear. All the EGA-computible boards I've seen duplicate this bug.

Note also that the video page size is recalculated. Programs that directly access the video memory of different pages should use the CRT_LEN value stored at memory location 0000:044Ch for the length of a video page. Programs should not follow the example of ANSLSYS. which hardcodes a page size.

Because of the recalculations the BIOS must make when using these function calls, the IBM documentation recommends you execute them right after a video mode set. That's not really necessary, but you should be using video page 0 (which is normal) and, if you're changing to a smaller number of displayable lines, your cursor should be somewhere near the top of the display, on a row lower than the number of rows you'll be changing to. In any case, if while fooling around with these programs your cursor ends up somewhere below the bottom of the displayable screen, just enter EGAMODE 3 (for color) or EGAMODE 7 (for monochrome) to return to normal.

The most popular of the new EGA screen formats is the 4-line most. Figure 3 shows a program called EGA43 to implement it. The program also fixes the investor on the Enhanced Color Display and the underline on the Monochrome Display. If you haven't loaded ANSLSYS (or some other resident program that messes around with the screen), you'll see that commands such as DIR work fire with 43 rows. Any program that uses DOS for simple teletype screen output issuch as EDIN and DE-

BUG) will also use the 43 rows.

Note, however, that DIR, //e (which pauses after a full screen) assumes the display has 25 rows. Until the EGA, there was no BIOS call that returned the number of displayable rows on the screen, so most programs that need to know the number of meason the screen just use 25. If the developers of the original PC BIOS had had the foresight to allow for an adapter capable of more than 25 rows, this would not be a problem.

Because of this deficiency in the original system board BIOS, you'll find that full-screen applications programs will react to the 43-line mode in one of three ways. If the program resets the video mode on entry, the display will go back to 25 lines. If the program does not reset the mode, it will probably use only the top 25 lines of the screen. However, EGA-aware programs are starting to appear that will pick up the information from the EGA BIOS and use all 43 lines. For example, my BROWSE program (in Programming/Utilities, PC Magazine, Volume 5 Number 6) will use all 43 lines. And some commercial programs, such as XyWrite III and Microsoft Word 3, have an option to use the EGA in its 43-line mode.

If you have loaded ANSI.SYS, even



using 2 blank scan lines with the 8 by 8 font.

■ PROGRAMMING/UTILITIES



Figure 5. EGA50 creates a 50-line display by throwing away the last byte of each character. The text is still readable.



Figure 6. EGA12 creates a 12-line display by making each character 28 scan lines high.

8 CK

the one that comes with PC-DOS, Version 3.20, you'll see that it assumes the display has 25 rows. ANSI.SYS users might want to look up Hersey Micro Consulting's Fansi-Console, Version 1.15, which, along with many other valuable features, supports ANSI functions on the EGA in

different screen formats.

If 43 lines seem too cramped for you, how about 35 lines? The EGA35 program shown in Figure 4 retrieves a pointer to the 50 y 8 font from the BIOS but stores the font in local memory with 2 blank scan lines at the end of each character. It then cloack the font (which is now, since we've changed it, a user-defined font) into the EGA through another BIOS call.

On the other hand, if 43 lines are not quite enough, you may want to try out EGA50, shown in Figure 5. It loses the descenders on the lowercase letters and makes commas look like periods, but it's

still readable.

Maybe you'd like something a little taller on your screen. EGA12, shown in Figure 6, doubles up the dots of the 8 by 14 font and creates a 12-line display. While this looks a little strange in an 80-column mode, try executing it after EGAMODE 1. This is a 12-line by 40-column display. Once again, commands like DIR are very happy with this format.

Finally, EGA25, shown in Figure 7, returns things back to normal.

Though Status and shown in Figures 3 through 7 may be un on EGAs attached to Enhanced Color Displays or Monochrome Displays. If you have your EGA attached to a regular old Color Display, you have your EGA attached not a regular old Color Display, you have most power of the color of the colo

THE PROBLEMS OF CURSOR EMU-LATION In the programs discussed above, I had to add some code to fix the monochrome underline and the color cursor. The fix to the monochrome underline is necessary because of a simple bug in the EGA BIOS. The fix to the color cursor is necessary because of a more complex bug.

Programs that set a cursor size usually assume that each character in a color mode has 8 scan lines. Setting the cursor to scan lines 6 and 7 creates the normal underline cursor. On the EGA, however, this would put the cursor in the middle of the character. For this reason, the EGA BIOS uses "cursor emulation" logic to translate a cursor size into something appropriate for a 14-scan-line character. (The cursor regis-



Figure 7. EGA25 loads the 8 by 14 font for the normal 25-line display.



Figure 8. EGA displays using more than 25 lines won't print correctly on a Shift PrtSe unless this EGAPRTSC program has been run. It replaces the standard PRTSC.

ters in the EGA also function differently from those in the CGA.) This cursor emailation algorithm, however, is based on the presence of an Enhanced Color Disjorather than on the size of each character. In the sample programs shown here, therefore, we first turn off cursor emulation by flagging a bit in lower memory and then restoring the bit when we're done.

You probably won't want to turn cursor emulation off entirely because programs that set the cursor size through the BIOS will then put the color cursor on scan lines 6 and 7 when your normal character set is 14 scan lines high. Even with cursor emulation on, you may see this problem with programs that go directly to CRT registers to set the cursor size.

Once again, this is a problem that could have been avoided had the designers of the original system board BIOS foreseen an adapter that had a variable number of scan lines per character and created a memory location (like the one the EGA BIOS maintains) to store this value.

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that easily. (See Application Notes on opposite page.) Fascinating, isn't it? Anything you can do with disks can be done with the Softstrip data strip system faster, easier and at lower cost - ON PAPER.

All you need is STRIPPER software at \$19.95 and the Softstrip System Reader at \$199.95.

DATA HANDLING

SEPTEMBER CASE HISTORY



Nick Tumer, editor of *Dr. Dobbs Journal*, has been making his own data strips to back up and store ardices, listings and other important materials. Turner roles that the STRIPPERT software "creates compact, marchine readable archives that are immune to date, of and magnetic fields." Siftige that Turner prints on this printer are filled in a loop leaf birder, along with the appropriate article. This permits him to pall the strip from the border and restl that him to pall the strip from the border and restl that him to pall the strip from the border and restl that him to him.

computer quickly using the reader. The method saves disk file space, since once an article has been printed, maintaining it on a disk for revision isn't required.

The STRIPPER system has solved another problem for the busy editor, intermachine file compatibility. Using the Softstrip® System, Turner can transfer files between his PC-clone and his Macintosh "with a minimum of fuss".

"It's about time we had a way to store files on paper in machine readable form,"
Turner comments.

Mr. Turner's comments are his own and do not reflect the opinion of the abilitation.

APPLICATION NOTES

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2

ACCUMENT.

PROGRAMMING/UTILITIES

printer? That happens because the Interrupt 5 Print Screen routine in effect is still the one in the system board BIOS, which is locked into using 25 lines per screen.

Fortunately, the EGA has its own Print Screen routine. It's virtually identical to the one in your system board BIOS except that it uses a variable number of lines per screen. When the EGA boots up, however, this new Print Screen routine is not automatically substituted for the old one.

The EGAPRTSC utility shown in Figure 8 rectifies this oversight by substituting the EGA Print Screen routine for the one in

your system board BIOS. If you intend to regularly use the various alternative screen formats that I've been presenting, EGAPRTSC should be part of your AU-TOCKEC.BAT file, and it should be very close to the top. It should be executed early excessed if you load EGAPRTSC after any resident program that also uses Interrupt S. (e.g., the PC-100S GRAPHICS program and some print buffers), these other programs will be locked out.

Of course, the EGA Print Screen routine does not support the printing of graphics screens created in EGA graphics modes. (Neither does the PC-DOS GRAPHICS program.) Nor will you be able to print the alternative fonts that you load into the EGA.

A NEW CLEAR SCREEN When using screen lengths of more than 25 lines, you'll find that CLS no longer works right, either. It, soo, suffers from the curse of the result of t

isters unchanged.

The program is different from CLS in some other ways. It doesn't ignore the screen color attribute currently in effect and doesn't wipe out a border (as CLS does when ANSI.SYS is not loaded), nor does it turn the screen white for graphics modes (as the ANSI.SYS CLS does).

A 43-LINE WORDSTAR WordStar, of course, is one of the few applications programs that can be easily patched for different screen formats. The patch points have been well documented and have remained consistent (in most cases) from version to version.

If you'll be using DOS in a 43-line mode, all you have to do to get WordStar to use 43 lines is to change the value at off-set 248h from 18h (which is 24 decimal) to 2Ah (42) or 2Bh (43). Using the latter value eliminates the display of the function

keys down at the bottom of the screen.

If you'll be using DOS with 25 lines but want to use WordStar with 43 lines, Figure 10 shows a patch to WordStar to switch to the 43-line mode on entry and restore 25 lines on exit by resetting the video mode. This patch assumes that nothing else is located in the WordStar patch area at offset 250h.

You can patch your copy of WS.COM and create a version of WordStar called WS43.COM by creating WS43.SCR in your WordStar subdirectory and executing

DEBUG < WS43.SCR

If you'd rather get an extra line of text instead of the function key definitions down at the bottom, change the line reading

E 248 2A

E 248 2B

A personal note: I use WordStar for both writing and program development. Before I got my EGA, I used to print things out to do extensive editing or get a better

■ I used to print things out to do extensive editing. With 43 lines, however, in many cases I have enough

many cases I have enough information right on my screen to avoid doing so.

perspective on program flow. With 43 lines, however, in many cases I have enough information right on my screen to avoid doing so. The increase in productivity with a 43-line mode is very real, and it can save lots of trees, as well.

THE 512-CHARACTER SET So far we've been looking at fonts that are simply substituted for the font normally loaded by the BIOS. However, an EGA equipped with 256K can actually store four entire 256-character fonts in its memory. If your



Figure 9. CS is an EGA-aware screen program that will work correctly with different screen formats.

248	3A		
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287	380	,	De-initieliee
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INT WW	12001 A		, Seve it
ELIA.	BL. BL		the 41 celumn mode
WW.	AL. 1112		
INT			
W77			Set cursor to block
807	AE.1		
INT			
738			
100			
			And re-set
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43-line mode of the EGA.

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USING THE EGA FEATURE CONNECTOR FOR A 120-COLUMN DISPLAY

You've probably heard of people who replace the crystals in their PC ATs to make them run faster. Did you know you can do the same thing with your EGA? With a video adapter, however, faster doesn't mean faster. Instead, faster means more: more dots and a higher resolution. By using a faster crystal with your EGA, you can go beyond the normal 80-column display.

We'll show you how. For well under \$15, you can construct the EGA External Clock Board described here that will let your EGA produce 120 columns on the Enhanced Color Display.

THE E.G. DOT CLOCK A BIT OF BACKGROUND In the EGA Video modes that use \$50 scan lines, the dot clock and all timing signals are derived from a 16.257-MHz crystal on the EGA board. Since your Enhanced Color Display requires a horizontal year net about \$1.000 per band of \$1.000 per background \$1.000 per backg

If you replace the 16 237-MHz crysta with something faster, you can generate more dost—and thus more characters—while still maintaining the 21.83-kHz horizontal sync rate required by the more contained to the control of the control

what is really amazing (for IBM) is that doing something like this is entirely supported by the EGA hardware and BIOS.

First, you don't need to actually replace the crystal on your EGA board with

one of a higher frequency. The mysterious Feature Connector that is a part of every Enhanced Graphics Adapter can route an external dot clock to the EGA Individues. That is partly what the Feature EGA BIOS lets you set up an area in memory containing new video parameter values that the BIOS will load into the CRT Controller registers to provide the correct timings for the additional color times. Another register that the BIOS will load directs the EGA hardware to on the board.

How high can this external dot clock frequency be? I've tested boards that use the Chips and Technologies EGA CHIP-Set with crystal oscillators up to 32 MHz. That makes a readable (but obviously tiny) 160-column display. The IBM

EGA, however, starts having flicker problems when you go beyond 28 MHz, so you're limited to about 140 characters. EGA boards from the same manufacturer may also have different limits. Your own board may be limited to 26 MHz, or it could go even higher than 32 MHz.

But let's restrain ourselves. Once you have the EGA External Clock Board built, you can experiment to your heart's content. I'm going to stick to one example here that will use a 24-MHz crystal for 120 columns on the Enhanced Color Display. (A similar technique can be used to create 120 columns on the Monochrome Display, but it presents software complications that I'll discuss later.)

BUILDING THE FEATURE You can build the EGA External Clock Board with just four parts, three pieces of wire,

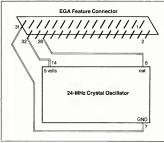


Figure A: A 24-MHz crystal oscillator that plugs into the EGA.

a soldering iron, and wire clippers.

The connection diagram is shown in Figure A. A 24-MHz crystal oscillator, the same size and shape as the 16.257-MHz crystal oscillator already on your EGA board, attaches to 3 pins on the EGA Feature Connector. Pins 32 and 31 provide 5 volts and ground, respectively. to power the oscillator. The 24-MHz output from the crystal oscillator connects to pin 28 of the Feature Connector.

Besides a little hook-up wire (less than a foot) and a little solder, all four of the parts you'll need can be purchased from JDR Microdevices, 1224 S. Bascom Ave., San Jose, CA 95128; (800) 538-5000 or (800) 662-6279 in Calif. The JDR prices and part numbers are shown in Figure B; equivalents are available from many electronic supply houses. When you get the parts, first cut the

JDR Item No.	Description	Price
0SC24 0 HDR-80	24.0-MHz Xtal Oscillator 2 × 40 header strip	\$4 95
	(breakable)	2.49
P25x45	Proto Board bare 2.5 × 4.5	
	inches	2 40
14 PIN ST	14-pin low-profrie IC socket	.11
		\$9 95
Add \$2.50 UP	S ground or \$3.50 UPS air del	very

Figure B: A list of parts needed for the EGA External Clock Board.

header strip (a knife will do it) so that you get a strip with 2 rows of 16 pins each. The long ends of the header strip will plug into the Feature Connector socket. Next, cut the perforated circuit board to about 11/2 inches by 2 inches.

Figures C and D show the front and back, respectively, of the constructed board. When you install the header strip on the circuit board, make sure the short pins go through the holes in the board so that the long pins can plug into the Feature Connector. Push the pins of the DIP socket through the holes from the other side of the board. If you're making a wire-wrap version, you can glue the header strip and DIP socket to the board and wire-wrap the pins. Otherwise, you simply have to cut three pieces of wire





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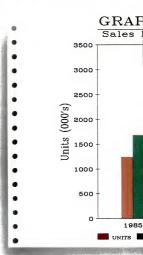
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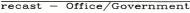
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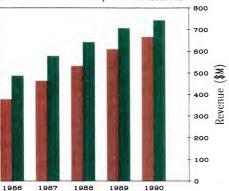
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■ PROGRAMMING/UTILITIES

("Using the IEEE Frame Common" common) and solder one end of each piece to the pins on the DIP socket and the other end to the long pins of the header strip. Note that the wires connect to the header strip pins on the front of the board and connect to the DIP socket pins on the hack of the board, so you'll have to run the wires from back to front through holes in the circuit board.

When everything is soldered and secure, clip any excess leads from the header and DIP socket to about ½ inch. Plug the crystal oscillator into the DIP socket so that the text on the oscillator case is right side up when you hold the board with the header strip at the top. You may have to shorten the leads of the oscillator so if its snauley into the socket.

Remove your EGA board from your PC and plug the EGA External Clock Board into the Feature Connector so that it is parallel to the EGA board. Put the EGA board back into the PC. Just be careful to make sure that the case of the crystal oscillator doesn't short out any contacts on the board adjacent to it. If it threatens to, just slip in an index card to separate the two boards.

SOFTWARE SUPPORT The EGA BIOS recognises only four text modes (0 through 3) when the EGA is attached to (through 3) when the EGA is attached to an Enhanced Cotor Display. Although mode 0 is normally a 40-column mode that is not used by most programs, we can redefine mode 0 so it uses the external crystal oscillator instead of the on-board crystal oscillator instead of the orboard crystal oscillator. If we store new values to be loaded into the CRT Cortroller registers. the EGA will display 120 columns where it is switched to video

mode 0. Figure E lists a program called 120COLS that provides the required soft-ware support for the EGA Esternal Clock Board. Use the 120COLS SCR file with DEBUG to create 120COLS COM, and then run 120COLS. You need only run this program once during your PC session, so you can put in your AUTOEX-BC. BAT file. Nothing will happen when you first run it. But now. It sy witching to

Figure E: This 120COLS program makes video mode 0 a 120-column when using mode the external clock.

video mode 0. You can do this either by

EGAMODE Ø

(which is a program shown in "Exploring the EGA, Part 1," PC Magazine, Volume 5 Number 14) or by executing

MODE BW40

 In a perfect world, programs would determine the current dimensions of the screen from the BIOS, but most just assume 80 columns. with the regular PC-DOS MODE command. Your screen will now switch to a 120-column by 25-line display. To get back to normal, use

EGAMODE 3

MODE COSØ

While in 120-column mode, you can also run EGA43, shown in the accompanying article, to, display 43 lines of 120 columns each.

You'll find that you can use DOS in 120-column mode, but pop-up utilities and applications programs may act oddly. In a perfect world, programs would determine the current dimensions of the screen from the BIOS and use those values, but you'll probably find that most programs just assume the screen is 80 columns wide. If these programs write to the screen through the BIOS, they will occupy only the left two-thirds of the display. If they write directly to the display memory, the beginning of the second row of text will start at column 81 of the first row on the screen and wrap around to the second row, and so forth.

This is too bad. When 120COLS has been loaded and video mode 0 is set, the EGA BIOS correctly sets up all the variables in the BIOS data area for other programs to use. Most PC programs, lowever, are "100 smart" to use these

The problem with doing something similar for an EGA connected to the Monochrome Display is this: The Monchrome Display has only one text mode, which is video mode 7. You won't want to redefine mode 7 to 120 columns, because then you will no longer have an 80column monochrome mode. Any program that writes directly to the screen will almost certainly have problems with 120 columns.

WORDSTAR REVISITED In the accompanying article, however, I showed you how to patch WordStar to produce a 43-line display. You can also patch WordStar for 120 columns with or with

Figure F: This script file creates WS120, which runs WordStar in 120-column mode.

out a 43-line display. While this display isn't very useful for normal word processing, it's a real dream for program development in C or Pascal or any other languages that use nested loops.

If you plan to use 120 columns in DOS, you need only patch offset 249h in WS.COM to 78h to tell WordStar to use

120 columns.

Or you can use DOS as you normally would and have WordStar switch to 120-column mode. The script file shown in Figure F will create a new version of WordStar called WS120 that saves the video mode on entry and switches to video mode 0. On exit, it switches back to the original video mode. You can create

```
U WU, CON

1 0011238 CON

2 0011238
```

Figure G: This script file creates WS43X120.COM, which uses a screen of 43 lines with 120 columns.

this new version of WordStar simply by executing

DEBUG <WS120.SCR

You must run 120COLS during your PC session for this new version of WordStar

session to this new velsion in Processing to work right. Figure G shows a similar script file that will create a WordStar program called WS43X120.COM that uses 43 lines of 120 columns. You can rename it to something shorter after you're done.

FURTHER DIRECTIONS Since we've socketed the crystal oscillator on the EGA External Clock Board, you can try out different clock frequencies by substituting different crystal oscillators. To develop the corresponding software support, you'll need the EGA Technical Reference to learn about the organization of the video parameters and the programing of the CRT Controller registers.

Use IXOCOLS as an example.
Readers familiar with digital logic circuitry might look at another aspect of the Feature Connector. Pins 20 and 21 are signals you can control from software using the Feature Control Register. You could put four different crystals and a 74153 multipleare chip on an external board and select which crystal to use by programming this register.

If you have a NEC JC-1401P3A Multisyme moine (reviseed in "The EGA Standard: Monitors That Messare Upi, "PC Magazine, Volume 5 Number 6, you have even more options. The Multisyne is not limited to a beritoration symmetre of 21.85 kHz, so you can use a higher crystal frequency to increase the number of scan lines as well as the number of scan lines are number of scan lines as well as the number of scan lines are nu

In any event, it is clear that by using the Feature Connector to expand the capabilities of the EGA, the board becomes more powerful than anyone has yet suspected.—Charles Petzold EGA has 128K, it can hold two fonts. A 64K EGA is limited to one font. Usually only one of these fonts is active at any one time, but you can tell the EGA which one you want to be active by using a simple BIOS call.

In addition, you can select any two of the four fonts to be active at the same time on the same screen. Instead of a normal 256-character set, this lets you use a \$12-character set. Since the ASCII code for each character is still limited to 1 byte, something else outside the character code has to specify which font is to be used for each character.

each character.

This "something else" is the attribute bit that normally indicates foreground color intensity. Instead of (or in addition to) making a character high intensity, this bit selects the alternate font. Thus if your

 An EGA with 256K can store four 256-character fonts in its memory. You can select two to be

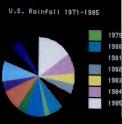
active at any one time.

word processor can display all 256 normal characters and can also use high intensity to represent boldface on the screen, you can use boldface instead to select an additional 256 different characters on your screen.

You may have noticed that in the fontcoding examples shown so far, register BL was always set to zero. Register BL specifies what the EGA BIOS calls the "Block to Load." This register can be set on my value from through 3, and it corresponds to the four fonts you can load into m EGA equipped with 256K. If the value of BL is set to 1, the font is loaded into look Li instead of block to. Since block to normally used for both low-intensity and light-intensity characters, you wen't see a light-intensity characters, you wen't see the EGA to use the intensity in to select the alternative four the second properties.

An example will make this clearer. Let's go back to EGAITAL (Figure 1),





EGA Mode

Plantronics Mode

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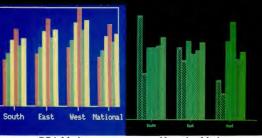
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CGA Mode

Hercules Mode

d That Automatically ur Every Mode.

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PROGRAMMING/UTILITIES

which loads an italic character set. EGA-ITAL can actually take a parameter that specifies the block (0 through 3) into which to load the font. If no parameter is specified, it loads the font into block 0. But now try running

EGAITAL 1

Earlier, when we ran EGAITAL with no parameter, the text on the screen became italic. Now, nothing happens. The italic font has been loaded into the EGA memory, but in block 1 instead of block 0. Block 0 still contains the normal font.

Now we have to tell the EGA two things: first, that we want block 0 to be used for low-intensity characters and block 1 to be used for high intensity; second, that we want to suppress the normal use of the intensity bit in the attribute byte.

Figure 11 shows a program called EGA512 that will do this. It takes two parameters that may range from 0 through 3. The first parameter indicates the font to use on low-intensity characters; the second is the font to use for high-intensity characters. If you execute

EGA512 Ø 1

anything that is high intensity on your screen will become low-intensity italic. Anything that is low intensity will remain the same.

To prove this, execute TEST512, shown in Figure 12. This program prints two lines, one in low intensity and one in high intensity. The high-intensity line will not be high intensity, but, rather, will be italic. Now, if you execute

NOV 1.1850 let Francesco NOV 1.1850 let Francesco NOV 1.1850 let Prancesco NOV 1.1850 let Prancesc	N 2CAS A 188	11.008	
1947 24 B. CK	HON AND HON AND HON HON SHL SHL SHL SHL SHL SHL SHL SHL SHL SHL	BL, 83 BB, (86C)] BB, 3 CX, RX BB, 1 BB, 1 BL, 3B AX, 1193 18 2X, 6712 CL, CB 5124 BB, 87 AX, 1898	; Lower 3 bice ; 2nd Parameter ; Lower 3 bits ; Save in Cx ; Shift BH left ; Combine with 3L ; Set block opec. ; Enable all planes ; thockers is ; blockers in equal

Figure 11. EGAS 12 lets you use a 512character set based on the foreground intensity bit of the attribute.

Figure 12. TEST\$12 prints two strings in low and high intensity to test or demonstrate a \$12character set.

EGA512 1 0

everything in low intensity will be italics (the block 1 font), and everything in high intensity will be the normal font (block 0). Finally.

EGA512 Ø Ø

turns everything back to normal. It makes both low intensity and high intensity have the same font. The EGA 512 program checks if the two parameters are the same and, if so, restores the meaning of the attribute bit to specify high intensity.

If your word processor works in text mode, does on-screen display of boldface, and doesn't reset the video mode on entry, try executing

EGA512 Ø 1

and see if you can get italic in your word processor instead of boldface. (Of course, then you have the problem of printing those extra 256 characters on your printer. But this is an article about video. Your printer is a whole other problem.)

You may be distressed at losing a highintensity character display when you see the 512-character set, but there's a way around that, no. In part 1, I showed you how to use the EOA palette registers to map the 4-bit IRGB code into a forth pRRGB code. With this technique you can map the low-intensity IRGB codes (where the "I" intensity bit is 0) into highintensity rgRRGB codes. The only play you're really limited to with a 512-character set is 8 forestroard codes in teach of 16

for the two fonts, since only the RGB bits of the attribute (and not the I bit) are used for foreground intensity. Using the palette registers, you can map these into anything you want.

Another alternative to restoring highintensity foreground is to invert all the bits of the two fonts and use another BIOS call (AX = 1003h and BL = 0) to enable background intensity instead of blinking. Now, since your characters are really backfor the two fonts. Your background is now limited to 8 colors (which is normal), and you can't use hardware blinking.

The underline on the monochrome display presents another problem. If you decide to remap palette registers to give you low and high intensity for each font, you'll be able to use an underline only in either low or high intensity, but not both.

THE POOR MAN'S FONT EDITOR Now that you've seen how you can load fonts into the EGA, you may want to create your own fonts. There are two ways to do it. You could start off with a piece of graph paper, draw each character by coloring in the appropriate blocks, translate each row of dots into a two-digit hexadecimal number, and then type these numbers

To create your own fonts, we'll be turning

your text editor into a font editor.

into a file. This is the long way.

It's easier to use anon-screen "front edior" program. You can then begin with an existing fort and make modifications to it. Of course, fort editors can be complex, but we'll be taking an inexpensive approach by turning your own text editor into a font editor. You'll be editing an assembly language fife that contains a series of assembler "DB" statements. You can then convert this file back into bytes with the IBM or Microsoft Macro Assembler. Figure 13 shows a program called

■ PROGRAMMING/UTILITIES

FONT2DB that retrieves an existing EGA font and translates it into these DB statements. The file created by this program is the program of th



Figure 13. FONT2DB prints an EGA font in binary format so that you can use your text editor to customize your own fonts.

in the .SCR file which values to change to use it for the 8 by 8 font.

If you simply execute

you'll get a listing of the font on your screen. By redirecting standard output,

FONT2DB >MYFONT

the font will be saved in a file called MY-FONT. Now you can load MYFONT into your text editor, turn off insert mode, and make changes to the font by replacing to with 1s where you want a dot, and 1s with 0s where you don't want a dot. To change the font height, simply de-

lete or add lines. You can use from 1 to 32 lines per character, but make sure each character has the same number of bytes, or your font will look quite strange.

After you've created your own font, the next step requires the IBM or Microsoft Macro Assembler. A shell program called

FONTLOAD.ASM is shown in Figure 14. The INCLUDE statement includes your edited font in the assembly. For more versatility, you may want to assemble your fonts independently and rewrite the loader program to load them from disk files.

INTRODUCING EGA GRAPHICS So far, in both parts of this article, I've shown you EGA features that you can use in text modes. (And you thought you bought your EGA for better graphics!)

cought your EAA to reletic graphics) in Programming graphics on the EGA in programming graphics on the EGA in graphics applications for the EGA, you should seriously consider using a "visual device interface," such as that found in Microsoft Windows or IBM's Graphics Development Toolkit. The Graphics Development Toolkit, for instance, consideration for the Compiler, or Lattice C (took not the BASIC C anticepted). Also, both the BASIC A interference Also, both the BASIC Compiler, or Lattice C (took not the BASIC C anticepted). Also, both the BASIC Compiler, or Lattice C (took not the BASIC C anticepted).

Define have lest of time to while away uniting for your errors to be pained, you could also use the BIOS for graphics. The EGA BIOS supports the same Read Dot and Write Dot function calls supported by the system board BIOS for the CGA. The only difference is that register BH must contain the video page. The BIOS Write Dot call is extremely slow, about 0.5 milli-seconds per dot on a normal 4.77-MHz PC or XT, to it takes a little under 2 minutes in the simplest case. Figure 15 shows the program (called WRITEDOT) that I used to



Figure 14. FONTLOAD loads a customized font in the format produced by FONT2DB. This program requires a Macro Assembler. time this. You can see for yourself how bad it is.

If none of these methods is good enough and you want to program your own graphics, you'll be writing directly to the video memory and programming the EGA registers. There is no better way to learn EGA graphics than to dig into the EGA Technical Reference and sweat it out. I'll show you some basics to get you started.

You'll get the fastest graphics routines by programming in assembly language. You can also program EGA graphics routines directly in any high-level language that supports BIOS calls, register output commands, and direct access of memory in a far sement.

Probably the best high-level language for programming EGA graphics is C, and that is what I've used in the EGADEMO program shown in Figure 16. This pro-



Figure 15. WRITEDOT demonstrates that the speed of the BIOS Write Dot routine makes it unsuitable for most graphics applications.

gram assumes your EGA is connected to an Enhanced Color Display. EGADEMO sets the video mode to 16, displays 100 random rectangles on your screen, sets the video mode to 16 again, and displays another 100 random rectangles by XORing (eXclusive ORing with the colors already on the screen). It then sets the video mode back to 3.

EGADEMO was written for Microsoft C, Version 3. Library functions that correspond to int86 and outp may be different for other C compilers, and so also may be the use of a far pointer for directly ac-

cessing the screen.

With Microsoft C, Version 3.00, the program can be compiled thus:

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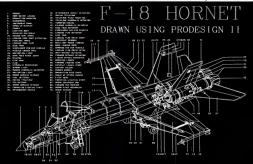
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> -Richard Aaron PC Magazine, March 19, 1986

66 Blends Software Publishing's ease-of-use methodology with features more common to heavyweight data managers. 99

"Intended for those who want ease of use without sacrificing versatility, Q&A has the look and feel of

the pfs: products but is easier to use." pfs: veterans can be up and running in short order with O&A's single-file data manager. Further examination, however, reveals flexibility more akin to data management heavyweights dBASE III or R:base

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"Symantec also had the foresight to include a host of conveniences usually found only in more ambitious programs: a keyboard macro facility for storing and recalling frequently typed commands or phrases, plus utilities for importing and exporting data and copying, renaming, and deleting files." _ Iim Heid

PC World, April, 1986







"Q&A smoothly integrates a word processor, file manager, and report generator to form a productive, even fun. business application tool, its Intelligent Assistant feature uses artificial intelligence technology to dramatically reduce the learning overhead. Useful. reasonably priced, well-made, not copy-

protected, Q&A is recommended." "The word processor and data manager are Q&A's two primary modules. Each of these applications is sufficiently powerful to compete by itself with popular word processors and data managers"

'Although Q&A's word processor is a stand-alone application, it is also an integral part of the data manager... Moving from one to the other is only a matter of a few keystrokes."

"One of the slickest features of the word processor is the print envelope command. If you type a letter, you do not have to type the address a second time in another file to print the address on an envelope, O&A reads the letter, finds the address, then spaces the address properly for a business-size envelope."

"Form generation is a breeze... You can draw boxes, center lines and set tabs...And you can create custom help screens for every field, which can be Important in an environment where several people may be using a database."

-Keith Thompson InfoWorld, January 13, 1986

reviews like these. had a database like this.

"GGA seems to me the quintessential manager's product."

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"An essential element of a good manager's software is that the person who's going to use it doesn't need to know much about it."

"Say I'm a broker in a securities firm. I want to have access to lists of my customers, salespeople, current buy-sell recommendations. I'll want customers' buying histories and performance figures for the salespeople. And that information needs to be updated frequently, possibly daily.

"But what I don't want to do is spend a few days setting up those databases.

"What I want is to sit down at the computer for a few minutes, set up some input screens, then hand the inputting job to an assistant.

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query mode lets you use some very sloppy phraseology to get back very useful information. You'll need to define your more casual terms once, but thereafter, specifying search criteria is ridiculously easy."

> - Jim Seymour PC Week, January 21, 1986

66 Q&A's database and word processor add features without giving up ease-of-use. 99

"Q&A includes among its many attractions not only the file manager and a report generator to extract information from those files and print it out as desired, but a quite useful word processor integrated into the package as well.

"The word processing segment of the software can, in fact, be used by itself...All of these features take the 'what you see on the screen is what you get on paper'

form."

"Information from Q&A files can easily be merged into documents produced by the word processing segment of the program. Consider, for instance, the ubiquitous form letter. All that is needed to generate the individually addressed copies of such a letter is to insert an esteriel as a marker on responding to an entry in the database.

"For example, entering 'Dear
"title" "last name" at the beginning
of the letter would result in the
automatic salutations 'Dear Miss
Willard', 'Dear Mr. Lewis', and so on
throughout the whole gamut of
individuals chosen to receive the
letter."

- Erik Sandberg-Diment The New York Times, March 9, 1986

66Highest comparative rating ever. ??

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stand, well organized, with excellent examples." "Excellent explanation of program

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—Software Digest, February, 1986

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MSC EGADEMO /Ze; LINK EGADEMO:

The /Ze parameter is necessary to enable the bold far keyword.

GRAPHICS MEMORY ORGANIZA-

TION When you program graphics on the EGA, you'll be writing directly to the screen memory. This memory is organized differently from the memory in CGA graphics modes. So let's first review what we know about the CGA and see how the EGA is different.

In the CGA-compatible graphics modes (4 through 6). In the dipslay memory occupies 16K, beginning at segment address 18000. In medium-resolution modes (4 and 5). In the 320 dots of each scan line require 80 bytes. Each byte represents 4 pixels with 2 bits each for the four colors. In high-resolution black-and-white mode 6, the 640 horizontal dots also require 80 bytes. Leady byte representing 8 pastels. In the 200 scan lines. The only complication is that all the even scan lines are at the of this position of this memory, followed by all the odd scan lines.

The display memory in EGA graphics modes 13 through 16 occupies the 64K segment heginning at segment address A000h. In graphics mode 16 (350) scan lines with 640 dots each and 16 colors), one screen's worth of data requires bytesper scan line times 350 scan lines times 4 (for the 16 colors), or 112,000 bytes. Two video pages are available, bringing total memory to 224,000—just below the maximum 256K on the EGA.

This 256K of display memory fits into a 64K memory space by being organized into four 64K color planes. The four color planes represent the blue, et al. green, and intensity hits that define the 16 colors. Each of the four color planes is addressed the same way. You specify which color plane you want to write to or read from by using the EGA rugisters accessible through output ports.

The byte at address A000:0000 is the leftmest 8 bits in the first scan line of the display. The byte at address A000:0001 is the next 8 bits in the top scan line. For graphics modes [4 through 16, the byte at the control of the bits of the byte at the control of the bits at the bits of the bits of the bits at the bits of the bit

second scan line. For graphics mode 13, the second scan line hegins at address A000:0028. The most significant bit al-

A000:0028. The most significant bit always represents the leftmost dot.

Although the division of EGA graphics

ly, you can actually write up to 32 bits of

memory into identically addressed color

planes initially appears clumsy, it has

```
/* SGADEMO.C — Compile with Microsoft C Version 3 with /Se parameter
to enable "far" keyword. Programmad by Cherlee Petsold. */
#include <dos.h>
#define MAXROWS 35#
#define MAXCOLS 64#
#define COLBYTES MAXCOLS/8
#define GRAFOUT(index,value) { outp(#x3CE,index) ; outp(#x3CF,velue) ; }
#define SWAP(a,b,temp) { temp = a ; a = b ; b = temp ;
mein()
          setvideomoda(16) ;
          randomrect (#
                                                                 /* Drew colored ractangles */
          setvideomode(16);
randomrect(0x18);
                                                                 /* Rectangles with XORing */
eetvideomode(moda)
                                                                 /* Sate video mode */
          int mode ;
          union REGS rags :
          regs.x.ax = node ;
int86(0x10, arege, arags) ;
randomract (fnct)
                                                                 /* Drews 188 rectenglee */
          int fact :
          unsigned int i, rl, cl, r2; c2, temp ;
          /* Function Register */
                     if (r1 > r2) SWAP (r1, r2, tamp)
if (c1 > c2) SWAP (c1, c2, tamp)
ract(r1, c1, r2, c2, rand()%16);
rect(r1, c1, r2, c2, color)
    unsigned int r1, c1, r2, c2, color;
                                                                 /* rl <= r2 end cl <= c2 */
           cher for "addr = (cher for ") (@xA###### + COLBYTES*rl + (cl>>3)) ;
          int numrows
int numcols
                              = r2 - r1;
= (c2 >> 3) - (c1 >> 3) - 1;
                                                                           /* Number of rowe */
/* Number of columne
./
          cher lmask
                              = 0xFF >> (cl & 7);
= -(0xFF >> (c2 & 7));
                                                                            /* Mask for left */
/* Mask for right */
          register row, col ;
          if (numcols < 0) {
                                                                 /* Adjustment for small rows
                     lmask 4- rmack ;
                     rmask - numcols - 0 .
          GRAFOUT(#, color);
GRAFOUT(1, #x#F);
                                                                 /* Sat/Reset Register */
/* Enabla Bat/Reset Register
          for (row = 0 ; row < nunrowe ; row++) (
COUPOUT(6, lmask) ;
                                                                            /* Bit Mask Register
                     "(addr+) &= 1;

CARFODT(6, FarP);

for (col = 8; col < numcole; col++);

"(addr+) &= 1;

CARFODT(6, reask);

"(addr+) &= 1;

addr +> OLBITES - 2 - numcole;
                                                                            /* Left side */
                                                                            /* Middle pert */
                                                                            /* Right eide */
                                                                            /* Next row */
          GRAFOUT(#, #) ;
                                                                 /* Sat/Resat to normal */
          GRAPOUT(1, 8);
GRAPOUT(6, 8xPF);
                                                                 /* S/R Enable to normal
/* Bit mask to normal */
```

data (8 bits of four colors) by writing 1 byte to the display memory. Partially for this reason, the wrong way to program EGA graphics is to start off with a simple "Write Dot" routine and base all other graphics routines on this one function. You'll get much better speed if you try to take advantage of the EGA's memory organization rather than work against it.

HOW EGADEMO WORKS FGA.

DEMO illustrates the use of four of the EGA's graphics registers. Programming these registers correctly is necessary before you write graphics information to the display memory. These use the GRAF-OUT macro. In each case an index value is first written to output port 3CE. This defines which register we want to write to. Next, the value we want to write to that register is written to output port 3CF. Other EGA registers have different port addresses and work differently.

The first use of these registers is in the randomrect The value written to the Function Register (with index equal to 3) tells the EGA whether any data written to the display will be written without modification or will be ANDed, ORed, or XORed with the data already there. EGA-DEMO draws 100 rectangles without modification and 100 more with XORing. You can also program this register to rotate data being written to the display.

The rect function programs the Set/Reset Register with the color of the rectangle and also programs the Set/Reset Enable Register to enable the set/reset function for all four color bits. This is not the only way to handle color on the EGA. but I've found it to be the most convenient for solid fills.

The rect function also programs the Bit Mask Register. Since 1 byte of the EGA memory encompasses 8 horizontal pixels, you often need to protect some pixels from modification. Any bit in the Bit Mask Register set to 0 protects that bit from modification when you write to the display if that memory location has just been read.

Let me elaborate. When you read a byte at a particular address from EGA memory, the contents of all four color planes at that address are latched internally in the EGA hardware. This is a total of 32 bits, 8 in each color plane. When you write a byte at an address, either the contents of these latches are written back to memory if the corresponding Bit Mask Register bit is 0. or something else is if the bit is 1. In the rect function, the data written to each bit where the Bit Mask Register is set to I is the color value in the Set/Reset Register.

The rect function uses the Bit Mask Register for the left and right sides of the rectangle. This allows for rectangles that may not start or end on a byte boundary, since we want to protect the data to the left and right of the rectangle.

The C statement

*(addr++) &= 1

appears three times in the rect function: for the left side of the rectangle, the central part, and the right side. This statement looks as if it's ANDing the contents of the video memory with 1, but it's really not. All this statement has to do (besides increment the address when it's done) is read a byte to latch the internal EGA registers and then write a byte to write the Set/Reset color value to the unprotected bits. The value we actually read or write out makes no difference. All we have to do is perform a read and a write. This statement happens to do it very quickly.

(Watch out for your compiler, however. I originally had a 0 at the right of the expression shown above, but Microsoft's C. compiler "optimized" the statement to write only a 0 to memory! That would be OK in most cases, but not for the EGA.)

As I mentioned earlier, using the EGA Set/Reset Register is not the only way to do this, but it does indicate some of the strangeness involved in programming graphics for the EGA. The Write Dot routine in the EGA BIOS uses a different (but no simpler) approach involving the Map Mask Register. Having these two examples in front of you will help when you start exploring the EGA registers.

But as we've seen, there is much in the EGA to explore without getting anywhere near graphics. While the EGA will help make the transition to graphics-based software more pleasant to us, it opens up more potential in character modes as well.

Charles Petzold is a contributing editor of PC Magazine.

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One wily reader has found a way to halve the time it normally takes to load large spreadsheets in 1-2-3, Release 2.0.

THE BACKSPACE DISASTER

The readers of your column often use the sequence /mcELL_[185]* when they some to sequence /mcELL_[185] when they want to give a 1/23 cell a range name. This is a shortest for naming the current cell when there is a chance that there is already a cell with the same range name somewhere else in the spreadsheet. Putting in the backspace means that you don't have to go to the trouble of deleting CELL before you create in fragini. That is a dangerous thing to do, however, because if CELL arready exists somewhere else and if also second range name will be reassigned to the new current focation of CELL for the rew. current focation of CELL for the contraction of the contracti

Figure 1 is a good example of this. If you put the cursor on D3 and run marro Va, it will work its way down the column util it gets to 999 and then stop. This is a standard routine for testing values in a column. However, suppose that cell D5 has the range name B. (The name is in C5 in Figure 1.) After the macro has done its work, try thiting Good (F5) B. You'll lind it has how moved to cell D7! As the macro has done its work, try thiting Good (F5) B. You'll lind it has how moved to cell D7! As the macro up range name B and dragged it along with CELL to the bottom of the column. It would do that with any range name it met along the way.

/mcCELL to avoid that problem.

Mike Hunter

Arden, North Carolina
This is, indeed, an unpleasant kink in the

won't work every time, either. If your prendsheet doesn't already have a range by the name of CELL, you're in trouble. Trings to delete a nonexistent range name will get you a beep and a hung maters. It have added the line VI alove. Si, which have added the line VI alove. Si, which have added the line VI alove. Si, which ready exist somewhere, If I does exist and lob happens to have another name assigned to it, sure enough, the other range amme gets reassigned to D3. However, as the macro loops, it won't pick up any more range names.

FASTER LOADS

Release 2.0 of 1-2-3 loads the same spreadsheet more slowly than Release 1 A does. You can't solve the problem by saving the .WKS file as a .WK1 file. It still takes just as long to load.

However, Release 2.0 can be made to load files almost as quickly as 1A does. Before you retrieve your first spreadsheet, execute a /File Combine Copy Entire command. You don't actually have to do a

combine; if you like, you can back out of it with a series of Escapes. But now, when you load a file with the usual /File Retrieve routine, it loads nearly as quickly as it would with 1A. The /FCCE command seems to set a flag that makes Release 2.0 run more quickly. It will continue to run more quickly until you exit and load it again.

in my case, 1 find that this trick makes 1-2-3 load at 10 K worksheet from a flopyin 50 seconds instead of 2 minutes and 50 seconds—a substantial saving. 1 have automated the procedure by putting an empty file named DUMMY. WKI and an AUTO 123. WKI file on all my data disks. The autoloading file has an autoexee Vol macro as follows:

/fcceDummy / /fr{quit}

The macro combines DUMMY.WK1, which is empty, and then displays the 1-2-3 files on the disk.

These two small files take up space on



way 1-2-3 handles range names. However, Mr. Hunter's solution (macro \S)

■ SPREADSHEET CLINIC

my disks, and combining DUMMY takes a few seconds, but all subsequent file retrieves are much quicker. This awkward fix will have to do until Lotus improves the program or until I can afford a hard disk. J. F. Kirknatrick

Canyon Lake, Texas

This is another one of those Ripley's believe-it-or-nots about 1-2-3. I tried it with a 92K file and found that after I backed out of an /FCCE command, Release 2.0 would load the file in 40 seconds instead of 70 seconds. Not quite so dramatic an improvement as the one Mr. Kirkpatrick reports, but certainly worthwhile.

POOR MAN'S PROJECT MANAGER Even if you don't have several hundred dollars to spend on project management software, you can still do simple Gantt

charts with 1-2-3 or Symphony. The results shown in Figure 2 are for 1-2-3. Release IA, but the @char function in Release 2.0 and in Symphony gives you greater flexibility in drawing charts.

The model works by using the same format and essentially the same formula in the entire Gantt chart matrix of G8 to X16. The format is +/- and the formula (in G8) is shown in the figure. It produces the + signs and the periods and is set up with mixed references (the dollar signs) so that

Gantt matrix. Row 7 contains the beginning date of

SCHAR(SIF(GS7)=SD8#AND#ES7<(SD8+((SE8+1)*38)).35.32))

Figure 3: The Figure 2 formula to use with 1-2-3, Release 2.0 or Symphony.

because the column isn't wide enough, but the asterisks make a nice separator between the month names, in rows 4 through 6, and the rest of the chart. Finally, you need to have each task's start date in column D, and the number of months it will

take in column E. The formula in G8 (and the rest of the chart) works as follows: If the beginning of the month (G7) is greater than or equal to the task start date (D8) and the beginning of the next month (H7) is less than the end

of the project (D8 plus the length of the project), then print two "plus signs" in the cell. Otherwise print zero plus signs-that is to say, print a period. By using different time units, such as

weeks, days, etc., you can change the model to fit your requirements. And with 1-2-3. Release 2.0. or Symphony, you can substitute the formula in Figure 3. The logic is the same as before, but the 35 and 32 at the end of the formula let you choose the characters that indicate on the chart whether the task is ongoing. In this case, ASCII 35 is "#" and 32 is a space. You can nick what looks best for you.

> John Dove Springfield, Virginia

you can copy it easily to the rest of the EDITING 1-2-3 TITLES

Once you have set vertical or horizontal tieach month. G7, therefore, is tles with 1-2-3, you can't use the arrow @date(85,1,1). The result is not displayed keys or Home to move the cursor into the

frozen, or titles, area. As the program's manual explains, if you need to edit the titles cells, you can use the Goto (F5) key to get to them. A new set of titles appears, and any changes you make on them are reflected in the real titles.

A handy, undocumented way to edit titles cells is to /Move or /Copy something

A handy way to edit titles cells is to /Move or /Copy something into them from the unfrozen area of the spreadsheet.

into them from the unfrozen area of the spreadsheet. Either you can specify the destination range by cell address, or you can actually "point" to the titles area. If you "point" to the titles area, you get a temporary set of titles, as you would if you used F5; but if you use cell addresses, the new cell contents appear in the titles area immediately.

John Predmore Fairport, New York

RECALC OURK

Release 2.0 of 1-2-3 gives you several handy macro commands for recalculating only part of a spreadsheet. This is a great timesaver when your spreadsheets are large because you don't have to wait for the whole model to recalculate. However, {recalc} and {recalccol} don't automatically display the results of a partial recalc. 1-2-3 has to redraw the screen before any

new figures will appear. In Figure 4, if you change either Sales or Cost of Goods Sold, the Gross Profit figure obviously won't change if you have turned on manual recalculation. If you run macro \P, 1-2-3 recalculates the results but doesn't display them. For all you know, it hasn't done a thing. Macro \R, however,

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Figure 2: A way to make Gantt charts with 1-2-3, Release 1A.





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■ SPREADSHEET CLINIC

will not only recale the range, but display the new results. This is because the {windowsoff) (windowson) line forces 1-2-3 to redraw the screen. You'd get the same result if you used {pgdn} {pgup}.

Don McLuckie Plainfield, Illinois usually a calamity, since you can hardly move a muscle without 1-2-3 displaying the new results. Besides a screen refresh. any valid carriage return will give you updated results, and you can't get very far in 1-2-3 without carriage returns. But if you ever do end a macro with a partial recalc and don't move the screen, this quirk is worth knowing about.

 Displaying the recalc of only part of a spreadsheet is a great timesaver when your

This is true as far as it goes, but it's not

50.00 <-ć--17.88 Gross Profit

are the range named

(recalc PROFIT)

{recalc PROFIT} {windowaoff}(windowson)

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Figure 4: Macro \P will not show recalculation results, but \R will because it redraws the screen.

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ACCOUNTING WITH SIDEKICK

One problem with accounting packages is that you need the proper account number in order to enter anything. This usually means visually searching through a chart of accounts. If you print the chart of accounts to disk, however, you can call up the file under Sidekick's "dialer" feature to find the account number you need. The larger your chart of accounts, the more helpful this will be.

Eric W. Baker

I've been needing this trick desperately without even realizing it. A minor obstacle the concurred was that my accounting program won't let me print the chart of alcounts to a file, but SickKick, solved problem, too. While using SickKick's and-pasts facility to read the chart of accounts from the screen nock too long to be considered trivial, now that it's done I have only to update it when I add a new account number.

Another benefit here is that SideKick comes up instantaneously. My accounting program will let me visually search through the chart of accounts on-screen, but only after a drawn-out delay for loading the chart into memory. This trick is going in my permanent repertoire.

—M. David Stone

BASIC ANSWER TO CROSSTALK PROBLEM

As M. David Stone noted in PC Lab Notes (PC Magazine, Volume 5 Number 8), the DOS ECHO command, used with redirection, provides a simple way to send dialing and other commands to a modern, using the format

ECHO MODEMCOMMAND > COM1:

(or COM2:, depending on where your mo-

Crosstalk are barred from using this trick. The reason is that this command works only if the Carrier Detect option on your modern is set for "Forced true" (DIS witch 6 set DOWN on the Hayes Smartmodern 1200). If set otherwise, any attempt to echo commands to the modern gives you the message "Write fault error writing device COMI:." Unfortunately, Crossalk won't work properly if the carrier detect setting is forced true.

I discovered this when trying to add a modern command to my AUTOEXEC .BAT file. My modern insists on waking up set for auto-answer, and I wanted to

■ You can call up the file of your chart of accounts under SideKick's dialer feature, then use dialer's search feature to find the account number you need. turn off the auto-answer without having to load Crosstalk. After finding out that I couldn't use the ECHO command and Crosstalk too, I turned to this simple BA-SIC program:

10 OFEN "COMI:1200,n,E,1,CE,DS,CD" AS 01 29 MS-"ATGE-4" 30 PRINT 01,MS 40 CLOCE 50 SYSTEM 60 ESO

The OPEN command initializes the Com port. The first five items are similar to the mode command, giving the Com port, baud rate, parity, number of data bits, and number of stop bits. The last three items (CS, DS, and CD) tell the system to items (CS, DS, and CD) tell the system to items check class to send, data set ready, and carrier detect lines. Line 20 defines WS as ATS0=0, the command to turn off auto-answer. Line 30 sends the command to the modern. Line 40 returns to DOS.

I named this SLEEP and added the line

BASICA SLEEP

as the last line in my AUTOEXEC.BAT file. Now when I boot up my system, its last wake-up exercise is to go into BASIC, load SLEEP.BAS, turn off the auto-answer on my modem, and go back to DOS. Colleen Delanev

Roselle Park, New Jersey

There's no reason to stop at this. By changing the modem command in this file, you can send any instruction to the modem. To phone local information with a Hayes-compatible modem, for example, change line 20 to

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Finally, you can tie it all together with Application EXPRESS. First, you design your own multilevel system of menus. Your first menu level might look like this:

Aunt Betty's Sales Reporting System (1) Enter Sates Date (3) Print Daily Sales Report. (4) File Processing

For each menu choice, you assign an action. For example, to define

menu choice #3, choose the action 'PRINT," select the report you just created in Reports EXPRESS, and specify the appropriate data sorting and selection criteria. Then Application EXPRESS automatically writes the program code.

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POWER USER

20 WS = "ATDT 5551212"

Save the file as INFO.BAS, then create a file INFO BAT consisting of one line: Now when you type INFO from the DOS

BASICA INFO

prompt, your system will call information for you. And you can easily modify the file so it will redial a busy number:

OPEN "COM1:1288,M,6,1,Cs,Ds,CD" AS 61 W5-"ATOT 5531212" PRINT 61,0 LINE INFOT "DIAL AGAIN (Y/M)? "JOS PRINT 61,"ATO" CLOSE IP DS-"y" OR DS-"Y" GOTO 18

This file has three new lines: 35, 37, and 45. Line 35 asks if you wunt to redial. If you answer yes, line 45 sends you back to the beginning of the file and sturts all over. Line 37 tells the modem to hang up.

With CALL.BAT. your system dials, then gives you the option to redial.

Without this command, the modem would still be trying to establish communications when it got the rediul command, und it would react by hanging up. If you hear the phone ringing on your modem sneuker. you can tell the program not to dial again. but be sure to pick up the phone first.

I can't resist one more variation. Save this next program as CALL.BAS:

LINE INPUT "Call what number? "JNS OPEN "CONG.1288,9,6,1,05,05,05" AS \$1 PAINT \$1,"ADDT "NS PRINT \$1,"ADD "NS PRINT \$1," CLOSE
IP DS="y" OR DS="Y" GOTO 18
SYSTEM

As before, put the command BASICA CALL in a one-line BAT file, CALL BAT. When you type CALL at the DOS prompt, your system will ask the number to call, dial, and give you the option to redial .- M. David Stone

COLORLESS COLORS Sometimes it pays to ignore directions and boldly do the "wrong" thing. The screen definition menu for WordPerfect 4.1 gives you two options: one for a color monitor and one for a "Single Color Monitor (e.g., black and white or Compag)," If you dutifully follow the directions and choose option 2 when you have a Compaq, Word-Perfect provides you with only two choices for how characters will be displayed on your screen, and normal text and bold text show up the same in either case. Underlined text and underlined holdfaced text may be either reverse video or less bright than the surrounding text.

If you ignore the directions on-screen. however, and choose option 1 instead for the Compaq, you can then set individual "colors" (actually, a gray scale) for background, normal text, underlined text, bold text, and underlined bold text. In short, by choosing the "wrong" option, you can set the screen the way you like.

Philip M. Keves Columbia South Carolina

The WordPerfect 4.1 screen definition menu (reuched through the Ctrl-F3, 4, key sequence) is usuble only on systems with graphics capabilities-whether color graphics or monochrome gruphics. If you try to cull up this menu while using a standard monochrome adapter, you'll be informed that you can't do it. Satellite Software International has predefined the monochrome screen, und that's the only choice you get.

For those (Compaq owners, for instance) who have monochrome graphics cupabilities, the "Single Color Monitor" option on the screen definition menu is meant to simplify installation. SSI chose what it thinks ure the two best screen definitions and made them an either-or menu choice. Fortunately, the program will let you get at the item-by-item definition menu. I say "fortunately" because I don't like SSI's choices. On the Portable PC, ut leust, SSI's settings leave some text looking as if it's been chewed by bugs.

After playing with the screen setting on the Portable PC, I wound up with Background A, Foreground H, Underline I, Bold P. and Bold Underline P. With these settings, the background is black, the underlining subdued but solid, and the bold and underlined bold are brighter than normal text. You may want to change my choices, but at least this is a good place to sturt. (And while we're on the subject, my favorite settings on the EGA with the Enhanced Color Display are Background J (blue), Foreground H (gray), Underline C (dark green), Bold P (white), and Bold Underline K (bright green). -M. David Stone

PREFORMATTED dBASE SUM

COMMAND

The dBASE SUM command reports totals of numeric fields, but its output is Spartan at best-just the raw numbers and their field names. If you need a presentable record of the state of your data file on a given

date, it just won't do. Here's a useful idea for transforming dBASE's Report Form capability into a much-enhanced SUM command. Like SUM, it rapidly totals a file; unlike SUM, however, the totals are clearly, consistently formatted with headings and date. You don't even have to retype the long SUM

command next time. You start by making a copy of any FRM file you've written previously. Next, issue the MODIFY REPORT com-

mand and, at the second screen, specify as the Subtotal Field. Then answer Y to

SSI's screen definition settings leave some

text looking as if it's been chewed by bugs.

the inquiry about wanting a Summary Report. Finally, go back and remove the Subtotal Field, then save the .FRM file to disk

I'm sure Ashton-Tate never intended its report generator to be used this way, but it works! When you run a report modified in this way, only the headings and totals print out, saving a lot of time and paper. C.O. Brown

lacksonville Florida

■ POWER USER

Mr. Brown ought to be a salectman, to judge by the wijn be cont all MSE land haying Servent Jef the Report Form! First her hustless (BASE line accepting nothing ("") as a Subtonal Field. (You have to make some entry here or dBASE won't give you the chance to specify Summary! Report.) If you just some the report with " as the Subtonal Field, mowever, dBASE will laight alther every record first within the will laight alther every record first within the table. In the last the proportion with a table, but they'll be reported notice-first as substantials, them such that the table, but they'll be reported notice-first as substantials, them such that they will be the substantials and they will be substantials.

However, by then modifying the Report Forms Mr. Brown suggests, by removing the "", you further trick BBASE into suppressing the "*" SUBTOTAL" line entirely. After that, whenever you want global totals from your file, just type REPO FORM

filename. Pretty slick!
You could use this same FRM to total segments of gile by adding a SET FILTER TO or a FOR condition. Or you could make a permanent disk record of this nicely formatted data by adding TO FILE filename to the REPORT command.

GOING TO BAT FOR DESOview

-Brad Stark

DESQ/wiw's ability to run the same program simultaneously in different windows gram simultaneously in different windows can be a blessing to the power user who needs to switch back and forth between needs to witch back and forth between two two different spreadsheets, for example, but two different spreadsheets, for example, but two different spreadsheets, for example, be sophisticated user, you have to worry that the be or she may do something footish, like to opening up the same database in two windows and trashine the data files.

Fortunately, DESQview can run batch files, which provides an elegant way for the more experienced user to protect a novice from his mistakes.

When adding a program to run under DESQview, use the batch file name as the "Command to start program"—WP.BAT for word processing, SS.BAT for spreadsheet, etc. Then create batch files of the following format shown in Figure 1.

Line I tells the system not to echo each command to the screen. Line 2 tells the system to look for a file called DVSTOP in the root directory of drive C:. (This assumes you are using a hard disk.) The first time you open a window, the system won't find DVSTOP and so will got line 3. This line tells the system to create the file C: \DVSTOP, after which it will follow whatever commands you add for running the program. When you finish running the

C: VDVSTOP. Line 6 tells it to skip to the end of the batch file, after which you can close the DESOview window.

the program. When you finish running the program, line 5 tells the system to crase opening another, the system will read the

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■ POWER USER

```
echo off
if exist C:\dvstop goto nogo
echo xxx > c:\dvstop
      COMMANDS FOR RUNNING THE PROGRAM GO HERE
erase c:\dvstop
goto end
inogo
         Sorry, this system is set up so you can
echo
         only open one window at a time. To close this
echo
         window and return to the application you were
echo
echo
        using, please:
Type "Alt" to bring up the Desgview Menu
Type "C" to close window
Type "Y" to confirm
acho
echo
iend
```

Figure 1: A batch file to prevent novices from opening a serond window in DESQview.

second line, look for and find the file C: \(\DVSTOP\), and then jump to the \(\DVSTOP\), and the \(\DVSTOP\) is will be \(\DVSTOP\) in the \(\DVSTOP\) in the \(\DVSTOP\) in the \(\DVSTOP\) is a \(\DVSTOP\) in the \(\DVSTOP\) in the \(\DVSTOP\) in the \(\DVSTOP\) is a \(\DVSTOP\) in the \(\DVSTOP\) in the

but a novice user will be protected.

If you use this trick, be sure to add the command ERASE C: 'DVSTOP to your AUTOEXEC.BAT file. Otherwise, if you get hung up and have to reboot. DESQview. will refuse to open even the first window.

Vincent dePaul Brooklyn, New York You can also use this trick ware selective, creating a different "stop" file for each application. That wary was can limit the warker user to och one deutheave window at a time ha still be the system open ap a word processing window. O'vo would almost deutheave window have a fine of two distributes upplications, which is done by listing each in we spranted you the Distribute applications and using separate "stop" files.

"M. David Stops."

1-2-3 TO dBASE III

I've often shared Dan Donzalski's frustration (Power User, PC Magaciae, Volume 4 Number 23) when converting Lotus's 1-2-3 worksheets to dlASE III. The alternative procedure I recommend is to create a 1-2-3 print file whose range includes only the data (not the headings). Set the left margin to 3 and the right to 240. Select Options Other Unformatted, then Go. For best results, reset any numeric formatting



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■ POWER USER

options in the spreadsheet first.

Your dBASE file structure must be set up with the same field widths as the 1-2-3 columns. The dBASE import command is

APPEND FROM filename.PRN SDF

Brian Gallagher E. Greenbush, New York

I always feel a momentary exhilaraion-like the feiting you get when taking off and landing in a jet-when a fit inports cleanly between software systems. Mr. Gallagher's letter shows how easily you can export from 1-2-3. The file produced by Lons is in pure ASCII format with each spreadsheet row delimited by a carriage return-line feed. Most word processors and many other applications can read this format, as well.

If you find it useful to export data often, set up a 1-2-3 macro. Create and name the data cell range. Then execute

\RPR rangename"
\RR rangename"
\PF filename.PRN"
\OOUNLB"HR248"MT8"MB8"QAGQ

Exporting from dBASE back to 1-2-3 is

COPY TO filename. TXT DELIMITED.

as easy as typing

"DELIMITED" consex dBASE to format the output file with each field separated by a comma and character fields enclosed in double quotes. Once back in 1-2-3, position the cursor where you want the data to drop in and type

FIN filename.TXT.

1-2-3 will note the common and create the column structure accordingly, converting the quoted strings into labels.

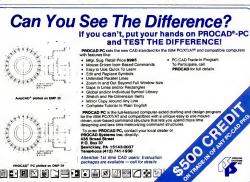
Unfortunately, symething is lost in the

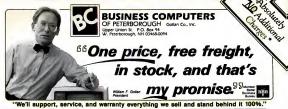
translation: your formulas. What you see is what you get. Another potential problem is 1-2-3's informate 240-character width limit for importing and exporting. If these limits don't get in the way, however, you can switch a file back and forth between 1-2-3 and dBASE, toking advantage of each program's special strengths.

Incidentally, one of the advantages of the new dBASE III Plus is that it will allow you to APPEND 1-2-3. WKS files directby.—Brad Stark

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USER-TO-USER



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(TEMPORARY) HARD DISK ZAPPER

As a precaution against losing files on my hard disk when debugging new programs or testing unknown programs obtained from bulletin boards, I first switch over to a RAMdisk and then run a short program called HARDOFF.COM. This short program temporarily disables access to my hard disk and creates a new file called HARDON.COM that I can run to restore hard disk access

You can create HARDOFF by running the HARDOFF.BAS program in Figure 1. If your computer boots directly from your hard disk, before running HARDOFF you may first want to copy COMMAND .COM to your RAMdisk and then issue a command like

SET COMSPEC=D:\COMMAND.COM

to tell your system to look on the D: RAMdisk for its command processor. Also, while HARDOFF can prevent

much unauthorized meddling with your hard disk, it's not foolproof. Someone determined to be destructive can bypass virtually any type of protection.

Finally, clone users should note that since the program is dependent on BIOS interrupts, it may not work on so-called IBM compatibles.

Les Moskowitz Stevenson, Maryland

We had to log into a D: RAMdisk, copy COMMAND COM and HARDOFF COM onto it, set the new COMPSEC, and then run HARDOFF, then HARDON, and then HARDOFF a second time to prevent all they try this at their own risk.

access to our C: hard drives, but it did prevent meddling the second time around.

This may be the only time you'll ever welcome the message HARDOFF's mechanism triggers:

General Failure error

reading drive C Abort, Retry, Ignore?

Also, in experimenting with this we noticed that several times we had created a zero-length HARDON.COM file on our C: hard drive. When we tried to remove it, DOS snapped back an "Access denied" read-only message. If this happens to you, undo the read-only attribute with the DOS ATTRIB command, Charlie Petzold's

Program to create BARDOFF.COM -- by Les Moskowitz

118 PRINT "Checking DATA statement; please wait... 128 FOR B=1 TO 8:FOR C=1 TO 17

148 READ AS: IF C<17 THEN 168

158 24=24+VAL(AS)

168 NEXT:NEXT 178 IF 24=12838 THEN RESTORE:GOTO 268

188 PRINT "Error - Wrong number of data statements, 198 PRINT "or in big number at end of one line.":END 208 FOR B=1 TO 8:FOR C=1 TO 16

228 READ AS:TTL=TTL+VAL("AB"+AS) 238 NEXT

238 READ S:IF S=TTL THEN 278
258 PRINT "Data error in line ",B*18+338"
258 PRINT "Check figures and redo":END
278 TTL=8:HEXT:RESTORE
268 OFEN "BARDOFF.COM" AS \$1 LEN=1:FIELD \$1,1 AS D\$

296 FOR B=1 TO 8:FOR C=1 TO 16 316 READ AS:LSET DS=CHR\$(VAL("4B"+A\$))

328 PUT \$1:NEXT:READ DUMMY \$:NEXT:CLOSE

338 PRINT "BARDOFF. COM created" 348 DATA EB,34,98,EB,84,88,88,88,88,89,84,88,88,88,88,88,88,1185 358 DATA CB,BF,4C,88,BE,82,81,F3,A4,EB,88,68,61,72,64,6F,1831

36# DATA 6E,2E,63,6F,6D,##,BA,18,#1,B8,#1,43,B1,##,CD,21,1353 378 DATA 84,41,CD,21,CD,28,BA,18,81,B9,91,88,B4,3C,CD,21,1598
388 DATA 8B,D8,B1,33,BA,83,81,B4,48,CD,21,B1,88,BA,82,88,1628 398 DATA B8,88,42,CD,21,B8,88,88,B1,84,8E,D8,B2,4C,B4,48,1789

488 DATA CD,21,88,88,88,88,8E,C8,8E,D8,FC,B1,84,BE,88,81,BF,1929 418 DATA 4C,88,AC,AA,E2,FC,B4,3E,CD,21,CD,28,88,88,88,88,88,1613 Figure 1: HARDOFF .BAS file to create HARDOFF .COM temporary hard disk isolater. Ranning

HARDOFF COM later will prevent access to your hard disk and will automatically create a HARDON.COM file to remove the protection. Before ranning HARDOFF, copy it and COMMAND.COM to your RAMdisk and type SET COMSPEC = D. COMMAND.COM (substituting your RAMdisk drive for D: if necessary). Also, clone users should understand that



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ARE YOU PRISURE?

While the Shift-PrtSc instant screen dump is a terrific feature, at one time or another just about everyone has hit these keys by mistake, wasting much time and paper. The CONFIRM.COM driver created by the CONFIRM.BAS program in Figure 2 lets you confirm or cancel each print screen function before it springs into ac-

Install CONFIRM.COM as the last driver; any graphics screen drivers, such as GRAPHICS.COM, must be installed first. CONFIRM takes up approximately 512 bytes when resident and modifies the print

screen interrupt (hex 5) to point to itself. (This will also affect BASIC's LCOPY command.)

You may need to modify CONFIRM to work with certain IBM compatibles that have a different keyboard layout or numbering system. CONFIRM reads the keyboard port directly to ensure that it will work with programs that modify the keyboard interrupt vector. You may have to change the scan code for the Y and N keys if your computer uses a different keyboard format.

Jeff Sicgel

Most other tricks for preventing unwanted Shift-PrtSc dumps work by disabling the print screen feature more or less perma-

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CIRCLE 312 ON READER SERVICE CARD TANDY

```
188 ' Program for creating CONFIRM.COM -- by Jeff Siegel
110 PRINT "Checking DATA statements; please wait..."
    FOR B=1 TO 20:FOR C=1 TO 17
READ A$:IF C<17 THEN 150
128
130
148 24=24+VAL(AS)
150
     NEXT:NEX
168
     IF Z#=28738 THEN RESTORE:GOTO 198
     PRINT "Error - Wrong numuber of data statements,
170
188
     PRINT "or in big number at end of one line.": END
198
     FOR B=1 TO 28: FOR C=1 TO 16
288
     READ AS:TTL=TTL+VAL("&H"+AS)
218
     NEXT
     READ S:IF S=TTL THEN 25#
238
     PRINT "DATA ERROR IN LINE"; B*18+338
PRINT "CHECK FIGURES AND REDO": END
249
     TTL-0:NEXT:RESTORE
258
26₽
     OPEN "CONFIRM. COM" AS #1 LEN=1:FIELD #1,1 AS DS
278
     FOR B=1 TO 28: FOR C=1 TO 16
280 READ AS: LSET DS=CHR$(VAL("4E"+AS))
298 PUT #1:NEXT:READ DUMMYS:NEXT:CLOSE
     PRINT "CONFIRM. COM CREATED"
318 DATA E9, A6, 88, 58, 53, 51, 1E, 86, 56, 57, 33, C8, 8E, D8, C7, 86, 1658
328 DATA 14,88,88,81,88,87,82,33,DB,CD,18,B8,88,B8,82,D8,1571
334 DATA BE,50,84,8C,6,EC,6,B7,69,81,B9,88,88,FC,F3,A3,2186
346 DATA 85,D8,B8,88,B8,85,C8,BE,99,81,BF,88,84,B9,88,88,1928
358 DATA P3, A5, BA, 68, 88, EC, 3C, 15, 74, 84, 3C, 31, 75, F7, FB, BB, 2838
368 DATA 88,88,8E,C3,8C,CB,8E,DB,BE,89,81,BF,88,84,B9,88,2877
378 DATA 88,F3,A5,3C,15,74,1A,B8,87,8E,33,DB,CD,18,FA,33,1628
380 DATA C8,8E,D8,C7,86,14,08,83,81,5F,5E,87,1F,59,5B,58,1274
410 DATA 0F,4E,0F,54,0F,3F,0F,20,0F,1E,8C,C8,8E,D8,BA,D4,1458
428 DATA 81,84,89,CD,21,88,85,35,CD,21,89,1E,83,81,8C,C8,1539
438 DATA A3,85,61,8A,83,81,88,85,25,CD,21,1F,88,88,31,8A,1481
44 DATA 10,88,CD,21,28,58,72,59,6E,74,2D,53,63,72,65,65,1366
458 DATA 6E,28,6C,6F,63,6B,65,72,28,8D,8A,28,41,6E,73,77,1278
468 DATA 65,72,28,55,28,74,6F,28,78,72,6F,63,55,64,65,28,1397
478 DATA 77,69,74,68,28,78,72,69,6E,74,2D,73,63,72,65,65,1688
488 DATA 6E,28,8D,8A,28,41,6E,73,77,65,72,28,4E,28,74,6F,1198
```

580 DATA 65,6E,20,8D,8A,24,08,88,88,88,88,88,88,88,88,382 Figure 2: Program to create CONFIRM.COM screen dump controller, Load CONFIRM.COM after any other graphics screen drivers. Once loaded, CONFIRM will intercept screen dump commands and offer you the choice of confirming or canceling them.

DATA 28,71,75,69,74,28,78,72,69,6E,74,2D,73,63,72,65,1546



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nently. This gives you total control over screen dumps without forcing you to run little .COM files each time you want to activate or cancel the PrtSc feature.

LITTLE RED RESET SWITCH

The PC is a wonderful machine, but it lacks a reset button to recover from system freezes and fatal errors; the only option is to hit the big red switch, wait until excess energy dissipates, and then flip it back on. The problem with this is that each time you turn on the machine you send a power surge through all your system circuits and your monitor. Nothing ages a machine like frequent surges.

It's fairly simple to install your own doit-yourself reset switch, since the actual circuitry already exists. Pin 11 of the 8284 chip is "low" and drives pin 10 "high." When you activate this circuit, you reboot

Pin 10 connects to pin 21 of the 8088 CPU. the machine. So all you have to do to reboot your system is to momentarily "drag" pin 11 low hy making an open circuit between it and pin 9 (ground).

Once you take off the cover of your PC, you'll find the 8284 in the center toward the back, between the first expansion slot



Figure 3: Pin lervout of the 8284 chip. The notch is at the top, pin 9 at the bottom left, and pin 11 the second from the bottom on the right.

and the 40-pin 8088 chip (the 8284 is the only chip in your system with 18 pins). Take out any expansion boards that might be in the way, and unhook the power supply wires and ribbon cables if you need more room to work.

The chip's pins are numbered counterclockwise from the top left of the chip (see Figure 3). The top is marked by a notch. Pin 9 is at the very bottom left, and pin 11 is the second from the bottom on the right.

Strip about 1/16 of an inch of insulation off the ends of two pieces of 22-gauge stranded wire. (You want only enough exposed, hare wire to attach to the legs of the chip; don't strip off too much or you risk shorting between pins.) Coat (or "tin") the ends of the stripped wire with rosin core solder.

Hold the tinned wire parallel to one pin and quickly touch the wire with the soldering iron. To avoid heat damage, don't hold the iron to the wire very long. Repeat the

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■ USER-TO-USER

process with the other wire.

Attach the other ends of the wires to a 'momentary contact" or "open push-button" switch. I used a Radio Shack Catalog Part Number 275-1547 switch, but any similar reset switch will do. Solder the ends of the wires to the legs of the switch and wrap the back of the switch with insulating tape. I drilled a hole in the small removable plate in the back center of the machinc, but you can install it almost anywhere.

Replace any expansion boards and wires and put the cover back on. Plug the machine back in and hit the big red switch. Now whenever you lock up the machine, all you need to do is momentarily touch the reset button and the machine will do a hard boot. No more reaching for the startup switch and sending those ominous power surges through your machine.

> Michael J. Mefford Gleneden Beach, Oregon

 It's fairly simple to install your own do-ityourself reset switch, since the actual circuitry already exists.

my new reset button works wonderfully. However, I found it easier to remove the chip from its socket, do the soldering operation outside the machine, and then replace the customized chip. But be warned. Users who aren't too experienced with a soldering iron or who are unfamiliar with their PCs' innards should have a more ex-

I followed Mr. Mefford's instructions, and

perienced friend do the surgery. And even if you are experienced, proceed at your own risk. We don't suggest that you start soldering things onto your motherboard unless you really know what you're doing and have considered the risks such as warranty voiding and potential damage. Finally, if you do add the switch, don't hold the button down too long during a reset or you could hart your machine. - Chris Johnston

CTRL-Z BYPASS

I recently needed to verify the existence of particular text strings in binary files. Since the files were short. I wanted to use the TYPE command but couldn't, since TYPE stops as soon as it sees the first CHR\$(26) or Ctrl-Z end-of-file marker.

I could have used DEBUG but found an easier way. COPYing files to the screen (CON) works the same way as TYPEing them, but with one advantage-the COPY



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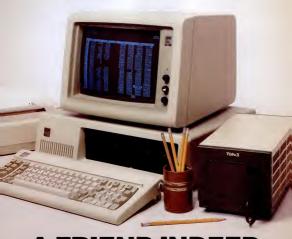
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command has a /B option that will ignore each Ctrl-Z character.

each Ctrl-Z character.

So to put the contents of COMMAND

COM on-screen, just type

COPY COMMAND COM CON /B

While this will display the whole binary file, you'll probably see all sorts of strange-looking characters on-screen, especially if you have ANSLSYS loaded. For a quick look inside a binary file, however, COPY filename CON /B is all you need

Bill Karwisch Chattanooga, Tennessee

Adding a B at the end tells the COPY command to copy the actual length of the file as reported in the directory listing. While this

Adding a /B at the end of the COPY command will display a whole file, but this trick will trip over CHR\$(7) beeps and other low-ASCII control characters.

trick will display the whole file, it will still trip over CHR\$(7) beeps and other low-ASCII control characters.

A better way to lunt for text strings in binary files is to use Charlie Petrold's terfrife BROWSE.COM (Programming/Utiities, Volume 5 Number 6), or The Norton Utilities' excellent TS.COM text search program.

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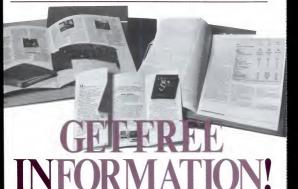
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PC TUTOR



Here are two commands you can create from DEBUG scripts to make an Epson printer output its graphics horizontally rather than sideways. Also, insights into interrupts.

TURNING GRAPHICS RIGHT SIDE UP
We been generating high-resolution
graphics images from BASICA by setting
the mode with SCREEN 2 and printing the
screen with the PC-DOS GRAPHICS program loaded. But GRAPHICS program loaded but GRAPHICS program loaded but GRAPHICS program loaded but graphication. I bried generating the screen images sideways, so
they'd come out right side up on the printre, but I encountered another act of prober, but I encountered another act of probtines of the printing of the printi

Paul Cottrell Stony Brook, New York

The problem is not the resolution of the printer. The problem is approximating the printer. The problem is approximating the 4-3 appect ratio ous see on your serven. Epson graphics (as implemented in the BM Craphics Pinner, for example are, for practical purposes, limited to 72 dois printed purposes, limited to 72 dois for printed purposes, the for printed purposes, the for printed purposes, the for printed purposes, the con print 480, 960, or 1920 dots or con print 480, 960, or 1920 dots or some and hinch page. These correspond, are proposed the printed purposes the printed purposes the printed purposes. The printed purpose the printed purpose the printed purposes the printed purpose the printed the printed purpose the printed the printed

If you use the 120-dpi mode to dump a high-resolution graphics screen, you'll end up with an image 5½ inches wide. But with the printer's 72-dpi vertical resolution, you're then stuck with printing the 200 scan lines either 2¼ inches high, which will moke your circles look like was

termelons, or, by doubling up the dots, 51/2 inches high, which will produce just the opposite effect.

After sying out both, I decided the first method looked beer. It is a tiny image, but if svery clear and, I have to admit, kind if it svery clear and, I have to admit, kind distallermative high-resolution graphics screen damp is shown in Figure 1 in the form of a DEBLO script file. Fou can use this so rereat HERAPS SCOM the "S" stands for "small"). First type the limit of the "S" of the "small" is the standard of the "s" admit show the standard service of th

DEBUG <HIGRAF-S.SCR

This will create HIGRAF-S.COM. You can then execute HIGRAF-S from the DOS command level or put it in your AUTOEX-EC.BAT file. Make sure if s executed after the GRAPHICS command. The image that HIGRAF-S prints is indented 12 spaces, so if s centered on an 8½-inch page.

The 240 horizontal dpj graphics mode prints 1920 dots across on 8-inch page, prints 1920 dots across on 8-inch page, This is exactly three times the dot width of a high-resolution display. Since this graphics mode can only print every bird dot, it seems ideal for your purpose. By doubling up the vertical dots, you can create an image 8 inches wide by 55 in ches high, which is fairly close to the 4-3 aspect ratio of the screen.

A program called HIGRAF-L ("L" for "large") to print high-resolution graphics in this mode is shown in Figure 2. Since each line of graphics is exactly 8 inches

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screen program.

Figure 1: Use this HIGRAF-S.SCR file with DEBUG to create a new high-resolution print

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PC TUTOR

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7 ; renain resident
(Figure 1 ends)

across, the program relies on the printer to da a carriage return and line feed at the end of each line. Because of this, the program will nat work an a wide-carriage printer.

These two programs are not optimized for speed, as is the PC-DOS GRAPHICS program, so they may be a little slower. GRAPHICS (at least in the more recent DOS versions) check if each little last any printable graphics data and skips the line if it doesn't. The HIGRAP programs will just keep shaweling zeros and to the printer on blank lines.

Both HIGRAF-S and HIGRAF-L will print a negative image; that is, the whiteon-black of the screen will be translated to black-on-white on the paper. This is narmal. If you'd prefer the images to be printed as they appear on the screen, change the NOP in each script file to a CMC.

As van can see, the logic to translate screen graphics to printer graphics is nat complex. If took me only about six or seren tries before I got it right. If you're programming in BASICA, you can also write your own graphics serven dump routines, suiting the POINT and PRINT commands. Remember to use a WIDTH "LPTI." 255 ta prevent line-folding in the middle of a stream of graphics bytes.

AX BX DG AB, 87 y new integrupt 5 ; check video mode AL,06 6120 AL,0656 s eath of not 6 DE, AX | mee if princ in NYTE PTR [0000], 81 | progress 0135 | print if not print if not PAR [8183] ; old interrupt 5 STTE PTR [6080],81 ; now doing it ; enable interrupt 83,6167 8191 03,08 83,6160 initial etring call PRINTETRING sero row etring for row call PRINTETRING sero column bytes to read 8191 CX,CX 8X,0400 AB,FD bytas to reed move into carry CMC for non-inv neve bit 31,1 collect bit get back bit collect bit 22,7 nest row DEC JNI MOV 2H 0150 MOV AL, BL CALL 61A6 CALL 61A6 CALL 81A6 SUB DX,+84 bits to print pest column pee if 648 column loop new 4 rowe pee if 288 prow loop CX CX,8288 8140 DX,+84 DX,88CE 8145 CMP 107,89CS 38 9145 MOV 8X,8112 CALL 8191 MOV 8TTE PTS (8888) POP EX serit etrino ; ell done CL, [BX] CE, CH , PRINTSTRING: 11 AL,[BX] 81AB 8196 ; call PRINT DE, DE AE, AE AE . 25 , see if error 0773 27% [0000],77 57,+02 0108 , error esit AX,3505 : INITIALIZE: #2#3],TO ; seve old int 5 [0105],ES ; set new int 5 DX, #1BA ; terminete and remain remident a 01

Figure 2: HIGRAF-L (at right) prints a highresolution screen 8 inches wide right side up.

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PC TUTOR

RETURNING FROM INTERRUPTS In disassembling some BIOS routines, I

In disassembling some BIOS routines, I found several places where a REIF 2 instruction is used to return control to the calling program. What is the difference between this and a simple IRET? Why would one be used instead of the other?

The reason I want to know is that I've been working on a program that needs to jump to the BIOS addresses instead of executing an interrupt. How does the stack work with INT and CALL instructions?

Steve Abrams

San Francisco, California

When an INT instruction is executed, the microprocessor pushes the flugs on the stack first, followed by the CS (Code Segment) register, followed by the IP (Instruction Pointer). Then it jumps to the beguining of the interrupt routine. An IRET at the end of the interrupt routine pops IP,

It's helpful when working with tricky stack operations to draw little diagrams of what the stack looks like. It's crude, but it works.

then CS, then the flugs. The REFF 2 instruction, however, pags IP und CS, und then udds 2 to the stuck pointer, effectively skipping over the flugs and leaving the stack in the same state as an IRET. (Although you'll see "RETF" in DEBUG, you cut' use this memonic with an ussembler. You must use a regular RET within a fur procedure instead.)

Both IRET and REFF 2 cause the stack to be left in the same state, but they are obviously different. IRET restores the state of the flags as they were when the INT instruction was executed. The REFF 2 returns the state of the flags as they are at the and of the interrupt procedure. REFF 2 is often used when the interrupt routine mass return a sations code through the Carrs flag (as with Interrupt 13h) or via the Zero flag (as with Interrupt 16h). If these routines used un IRET, that status code would be lost

You must also remember that hardwore interrupts are disabled by an INT instruction. An interrupt procedure that returns with a REIF 2 should enable interrupts with a REIF 2 should enable interrupts with an SII command before returning. An interrupt procedure must not do what interrupt 15th does in the PC-XT BIOS. That causes interrupts to be disabled after the return.

You can simulate an INT instruction in your own programs by pushing the flags on the stack with a PUSHF and then excuting a far CALL to the interrupt address. The IREF or u fur REF 2 at the end of the interrupt procedure will return to the address following your CALL. Muny of the crisident programs in PC Magazine's Programming Utilities column use this approach.

Alternatively, you could simulate an NT by pushing he flags, followed by the segment and office adulters values for the return address, and then do a far IMP. This is handy when you want the interrupt the text instruction after it is done. Or you could pash the flags, followed by the segment and officer values of the address to which you want to return, followed by the interrupt that the property of the property of the interrupt to the property of the

The IBM Macro Assembler manuals (and Inte's documentation of the 8088 and 80280 instruction sets) have full details of suck operations for each instruction that adjects the stack. Twe defin found it helpful when working with tricky stack operations to draw little diagrams lusting pen and paper) of what the stack looks like and where the stack pointer is pointing at every step of a given sequence of instructions. It's crude. but it works.

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